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A Review Paper on Thermal Performance and Emission Analysis of Single Cylinder CI Engine with Jatropha Oil, Blends with Pure Diesel

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ABSTRACT

In different researches many different types of alternative fuels are used. Based on literature review, it is concluded that for CI engine, Bio-diesel is the most promising alternative fuel. In this project works prospects increasing Jatropha biodiesel-diesel blend ratio as a working fuel in diesel engine is going to be studied by changing engine loads. Also based on experimentation most favorable blend and engine parameters are to be recommended for obtaining better performance. Jatropha biodiesel presents a very promising scenario of working as alternative fuels to fossil diesel fuel. The properties of Jatropha biodiesel can be compared satisfactorily with the characteristics required for I C Engine fuels specially C I engine. Experiments will be performed for three engine loads, i.e. 2,4, and 6 kg using pure diesel fuel and blends o Jatropha biodiesel-diesel i.e. J20, J40, J60, with constant speed of diesel engine. The parameters which will study in performance are thermal efficiency, specific fuel consumption, brake mean effective pressure and volumetric efficiency. The results of experiments observed with biodiesel blends were compared with that of baseline pure diesel.

1. Introduction

In India one of the largest energy sources is coal, followed by petroleum and conventional biomass and waste. Since, the starting of the new Economic Policy in 1991, increased Indian population has moved towards the cities and urban people have altered away from conventional biomass and waste to other energy sources such as hydrocarbons, nuclear, biofuels, and other renewable. India's transportation sector, earlier fueled by petroleum products, is set to increase as the country focuses on developing road and railway transportation. The government plans to authorize some alternative fuel use, particularly with biofuel blends, and grow greater use of mass transit systems to limit oil demand growth. India was the fourth-largest consumer of crude oil and petroleum products in the world in 2013, after the US, China, and Japan. The variation between India's oil requirement and supply is widening, as demand increases. The fuel usage of the crude oil increase day by day in India. This also increases in diesel fuel usage because diesel is a main resource of transportation and passenger vehicle. In this research, it is trying to decrease diesel fuel consumption. One of the solutions of this problem is using an alternate fuel, which can be mixed with diesel in certain proportion. By using alternate fuel, not only reduce the need of diesel but also helpful to nation by decreasing fuel usage and find and use the reproducible sources of fuel production and also tarnish the effect of greenhouse gases.

2. Characterization of Jatropha oil

Jatropha curcas is a large plant and belongs to the family of Euphorbiacea occurring almost throughout India. It has a long productive period of around 40-50 years. It grows as a tree up to the height of 3-5 mt. it is a good plantation for Eco-restoration in all types wasteland.

3. Availability of Jatropha oil

India has rich and abundant resources of both edible and non edible oil seeds.Jatropha curcus is a large shrub or tree commonly found throughout most of the tropical and sub- tropical regins of the world. Jatropha curcus plant is a drought-resistant, perennial plant living up to40- 50 yearsit can grow in saline and alkaline soils, arid and semi-arid condition.T he production of jatropha seeds is about 0.8 kg/m^2 per year. The oil content of jatropha seeds 40% by weight. Fresh jatropha is a slow drying, odorless and colorless oil, and turns yellow after aging. Jatropha an alternate fuel could be atributed to some important facts, Indian climate condition are suitable for Jatropha cultivation. Has no insect, pets and not browsed by animals, can survive long periods of drought.

4. Problems with Biodiesel

Major problems encountered with vegetable oil as bio diesel used in CI engine are its low volatility and high viscosity due to long chain structure. The common problems faced are excessive pumping power, improper combustion and poor atomization of fuel particles. The conversion of the vegetable oil as a CI engine fuel can be done any of the four methods; pyrolysis, micro emulsification, dilution/blending and transesterification.

5. Preparation of Laboratory Samples of Esterified Jatropha Oil

In the Satellite image fusion there are many approaches use based on frequency and spatial based. In this paper we have describe every methods till now. In this paper also presented comparative study of different methods of fusion. From that we can say that combination of two method will be the area of research in future.

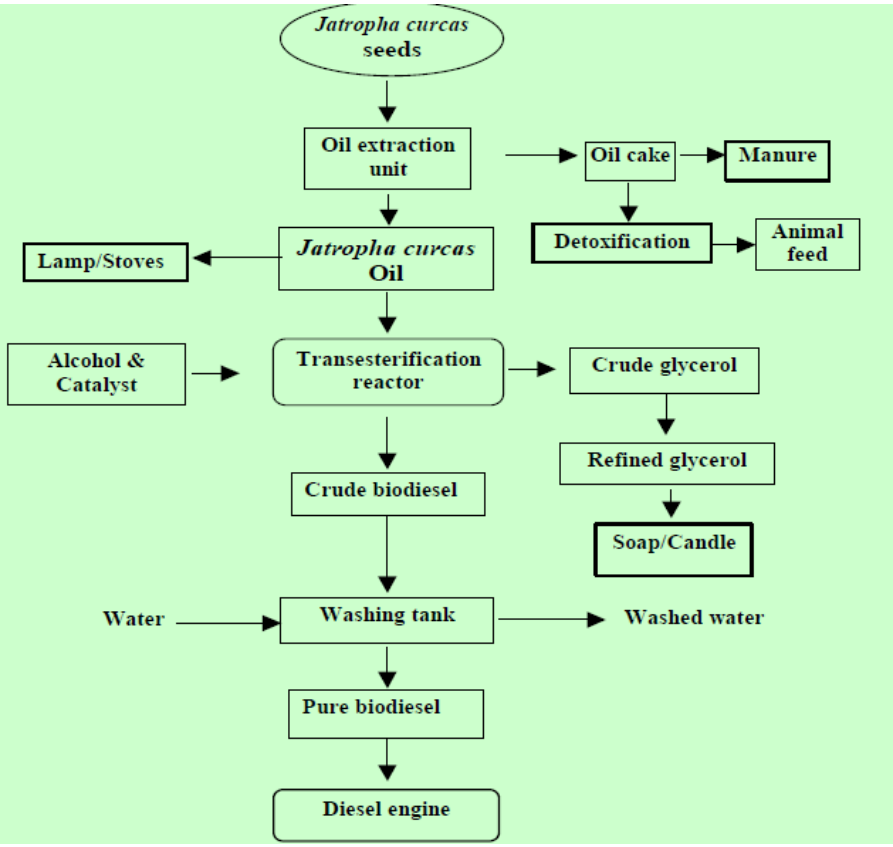

Fig. 1 Process flowchart for biodiesel production from jatropha seeds and by products

Jatropha oil is blended with alcohol and catalyst mixture in transesterification reactor. The reactor is kept at reaction temperature for specific duration with vigorous agitation. After reaction, the biodiesel and glycerol mixture is sent to the glycerol settling tank. The crude biodiesel is collected and washed to get pure biodiesel. Depending upon the need, the size of the unit can be scaled up to get higher production capacity. The fuel properties of jatropha biodiesel produced in th e pilot plant are given in the table 1

Table1Properties of Jatrophaoil Biodiesel

Type of source	**Renewable**
Calorific value (MJ/kg)	38.20 MJ/kg
Gross heat of combustion (KJ/kg)	40.135
Cetane level	38
Flash point (°C)	240(°C)
Pour point (°C)	471(°C)
Density at15(°C)	0.920gr/cm3
Viscosity at30(°C)	52 cSt
Sulphur content (wt. %)	0 (% w/w)
Fire point	274±3
Oxygen	11.06 (% w/w)
Carbon residue (wt. %)	76.11 (% w/w)

Table 2 Fuel properties of jatropha biodiesel and its blends with petroleum diesel.

Properties	**Blends**		
	B20	**B40**	**B60**
Viscosity (40o C, mm2 /s)	3.02	3.34	3.41
Cloud point (o C)	2	0	-1
Pour point (o C)	-5	-4	-4
Flash point (o C)	89	87	91
Heating value (MJ/kg)	45.4	44.7	43.3
Free fatty acids (%)	0.22	0.22	0.28

Formation of Jatrophaoil with its properties: - Oil Jatrophaoil, an oleaginous tropical plant, has the highest oil productivity per unit of land on earth. In terms of its usage, Jatrophaoil has various uses as a food, (oils, margarines, bread, mayonnaise, feeds, ice cream, cookies etc), in industry (soap, lubricants, detergents, plastics, cosmetics, rubber etc), in steel making, the textile industry, pharmacology etc. Among other crops for producing fuel, Jatrophaoil demonstrates good competitiveness. Commercial production of Jatrophaoil biodiesel in the Malaysian biodiesel industry uses refined, bleached and deodorized Jatrophaoil in the presence of excess methanol and alkaline catalyst, which is heated to the trans esterification reaction temperature and is passed through multistage continuous reactors. These reactors are used in a series to maximize the reaction conversion. Glycerol is removed after each reactor. After the reaction is completed, the excess methanol is recovered by flashing through the flash vessels and is distilled by using a methanol purification column with structured packing. The recovered methanol is then recycled and reused in the reaction process. The crude biodiesel is washed using hot water and is separated by centrifugal separation. The biodiesel is then dried under vacuum to achieve low moisture content of the final product, and is sent to the storage tanks. The glycerol is flashed to recover methanol and is sent to the storage tanks as crude glycerol.

Worlds largest. Production in Thailand: World's largest exporter of Jatrophaoil. It will produce about 15.8 million tones and exports 13.4 million tones and its export value of Jatrophaoil oil up to RM45 billion.

Figure 2 Jatrophaoil Tree

Figure 3 Jatrophaoil Seeds

6. Performance Analysis of Jatropha Biodiesel

Performance tests were conducted on stationary cylinders, diesel engine, by using Jatropha Biodiesel and its various blends with diesel from no load to full load condition. The tests were also conducted with conventional diesel fuel for comparison; Biodiesel is blended with diesel in proportion like 20%, 30%, and 40%. These blends are termed as JBD20 (20% Jatropha Biodiesel + 80% diesel), JBD40 (30% Jatropha Biodiesel + 70% diesel), JBD60 (40%Jatropha Biodiesel + 60% diesel). Petro diesel is used before and after the Jatropha Biodiesel and their blends for verifying the engine performances because biodiesel and blends. The diesel used before the Jatropha is denoted as Diesel2 and after the Jatropha denoted as Diesel3 for convenience. All the performance tests were conducted in the I.C. Engine laboratory.

7. Objectives of Project

Keeping in mind the benefits of biodiesel and so the consequential importance renewable in the near future, the work was undertaken with following specific objectives:

1. To conduct short term field test on C.I. engine.
2. To study performance of C.I. engine with biodiesel produced from Jatropha oil

In the present work, Jatropha biodiesel purchased from Mint-bio fuels ltd., Pirangut Pune. And their physio-chemical combustion properties were provided by same company. And then used for performance analysis in "4-stroke Single-cylinder water cooled diesel engine."

8. Scope of present study

From a systematic and exhaustive review of the earlier studies the scope of the present study is identified is as follows. A large number of experimental, thermal performance of natural gas and biodiesel used in diesel engines operated at variable CR and load and constant injection pressure. In these studies as the effect of load, blend, speed, injection timing, brake power, etc. on thermal performance and emission characteristics are studied. And observation made is as follows.

It is clear that no studies on thermal performance and emission characteristics at different preset compression ratios and at different load using blends of Jatrophaoil with proper percentage as a fuel are reported, and many studies have been conducted at a only constant compression ratio. There is only Jatrophaoil blended ratio with an only constant compression ratio, and Power output.

To experimentally evaluate the thermal performance and the exhaust gas mission characteristics of a diesel engine fuelled with Blends of Jatrophaoil as a biodiesel and its blends with diesel at different preset compression ratio and in addition to varying loads. To carry out on thermal performance and engine emission based on Compression ratio, load, blends, at operating condition etc.

The experimental study is to be conducted on a four stroke signal cylinder, variable compression ratio diesel engine using Jatrophaoil with its blending with diesel (B20, B40, and B60) .The thermal performance and emission characteristics are to be evaluated by running the engine at different preset compression ratios, and varying loads.

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