# Study on Biofuel Made From Jatropha Seeds

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*Abstract*— It has been found by using Jatropha with pure diesel IC engine can run with optimum performance. It is also found from the experiments that 30 B Jatropha has good result as compared to 30 B mustard oil in Brake power v/s BSFC. India has gone biggest importer of edible oil so it is not favour to use mustard as bio diesel. Blending of mustard cost as higher than the cost of blending of Jatropha biodiesel. In the engine test rig tests were carried out using diesel and biodiesel to find out the effect of various blends on the performance of the engine. Investigations are carried out on the engine mainly to the effect of brake specific fuel consumption, bake thermal efficiency and exhaust gas temperature. From the experimental analysis it was found that the blends of the Jatropha oil with diesel could be successfully used with acceptable performance on 20 B. On the result of this study properties of Jatropha oil suggest that it can be used directly as C.I. engine fuel. It is possible to run diesel engine with mustard and Jatropha Carcus bio-diesel blends. Brake thermal efficiency is higher for neat diesel at all loads and lowers for blends of bio-diesel and difference of brake thermal efficiency between neat diesel and blended bio-diesel decreases as load increases. Fuel consumption is nearly same for neat diesel and blended diesel at all BMEP and have lower value at all BMEP for neat diesel. BSFC for bio-diesel increases for higher blending of bio-diesel, because of the lower heating value of bio- diesel as compared to diesel fuel.

***Keywords:*** Biofuel, Jatropha Seeds

## I. Introduction

### A. Background

Rudolf Diesel invented Combustion Ignition (CI) engine during 1892. He tested itwith peanut oil as fuel, but with the advent of cheap petroleum, appropriate crude oilfractions were refined to serve as fuel and people did not pay much attention over fuel potential of vegetable oils.

But gradual depletion of world petroleum reserves, increase in crude oil prices,and impact of environmental pollution results in renewed focus on vegetable oils andother renewable lipid sources. These resources have less environmental impact than the traditional ones. Therefore, in recent years systematic efforts have been made by several researchers to use vegetable oils and their esters (biodiesel) as fuel in CI engines. Vegetable oils have already been directly used in CI engines as they have a high Cetane number and calorific value very close to diesel. However, the brake thermal efficiency was lower to that of petro diesel. Beside this vegetable oils have high viscosity and low volatility; it leads to difficulty in atomizing the fuel and in mixing it with air. Therefore, engine emits more smoke, hydrocarbon and carbon-monoxide. Direct use of vegetable oils caused carbon build up in the combustion chambers and on the injector nozzle tip in long hours of operation.

But mono-alkyl esters of long chain fatty acids (biodiesel) is a promising substitute of petro diesel fuel that can be produced from natural, renewable resources such as wide variety of vegetable oils and animal fats. These resources are biodegradable and nontoxic. The term, biodiesel, was first introduced in the United States during 1992 by the National Soy development Board (presently National Biodiesel Board), which has pioneered the commercialization of biodiesel in the USA.

Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend or can be used in its pure form. It can be stored just like the petroleum diesel fuel and hence does not require separate infrastructure. Beside this biodiesel has almost no sulfur, no aromatics and has about 10% built in 02. Which helps it in complete combustion.

The requirement of petro diesel in India is expected to grow from 39.815 MMT in 2001-02 to 52.324 MMT in 2006-07 and just over 66 MMT in 2011-12. The domestic supply of crude oil will satisfy only about 22% of the demand and the rest will have to be met from imported crude [2]. India's dependence on import of petroleum oil will continue to increase in future. Beside this there is a need to meet the global environmental concern about climate change, ensure energy security, reduce imports bill, and generate employment for the poor. These factors make it necessary to search for alternative, renewable, and environmental friendly fuel, like biodiesel which can reduce imports bills and can generate employment for the poor. Biodiesel is environmentally superior fuel and its use becomes compelling in India if the prescribed emission norms, Bharat Stage II and Bharat Stage III (Annexure) are to be achieved.

Biodiesel has already been accepted as clean alternative fuel in USA with production of 100 million Gallons per annum. Each state of USA has passed specific bills to promote the use of biodiesel with reduction of taxes. Soybean is considered as main source of biodiesel in USA whereas sunflower and rapeseed oils are extensively used in Europe. Palm oil and frying oil/animal fats are sources of biodiesel in countries like Thailand and Ireland. In most of the countries, biodiesel is used in engines by blending with diesel. USA uses B20 biodiesel; France uses B5 as mandatory in all diesel engines [2],

The use of non-edible vegetable oils compared to edible oils as feed stock for the biodiesel production is very significant in India's perspective due to higher demand of edible oil as food than its domestic production~ There are many tree species, which bear seeds rich in non-edible oil, some of them are very suitable for our conditions such as Jatropha curcus (ratanjyot), Pongamia Pinnata (honge or karanja) and Mesua-ferrea (Nahar or ironwood).

### B. *Aim and Objectives*

The aim of the present study is to production of biodiesel from Jatropha curcus, Mustard oil and evaluation of performance test of different blends of SVO's and biodiesel with petro diesel in a CI engine. The following are the major objectives to fulfill the aim of present study.

1) Processing of biodiesel from SVO's Jatropha curcus and Mustard oil.
2) Performance evaluation of CI engine using different blends of SVO's, biodiesel and petro diesel.
3) 3 .Comparison of performance of biodiesel blends and with petro diesel in an engine setup.

## II. LITERATURE REVIEW

Kumar et al. used non-edible oils for biodiesel production. Reaction performed in the presence of catalytic NaOH/H2SO4 at 70 °C. Result shows that Transesterification of oils is affected by the mode of reaction, molar ratio of the glycosides to alcohol, type and quantity of catalyst, reaction temperature, reaction time and purity of oils and fats.

Foidl et al. prepared methyl and ethyl ester of Jatropha oil by transesterification process using KOH catalyst, and found 92% yield and 88.4% yield for methyl and ethyl ester respectively. They reported that due to higher cost involved with ethanol process, it is better to produce methyl ester.

Ramadhas et al. described various methods by which vegetable oils can be used in CI engines. Overview of transesterification process to produce biodiesel was given for introductory purpose. It is reported that enzymes, alkalis, or acids can catalyze process. Alkalis result in fast process.

Bradshaw received a patent for a transesterification process that added about 1.6 times the theoretical amount of an alcohol, such as methanol, which contained 0.1 to 0.5% sodium or potassium hydroxide, to an oil or fat. When performed at 80°C, this process provided 98% conversion to alkyl esters and high-quality glycerol. These patents contain the following observations about the transesterification process.

Kandpal et al. prepared methyl ester of the fatty acids from Jatropha oil by treating 1g oil with 10 mi sodium methoxide and refluxing this mixture at a temperature of 70-90°C for 1 hour. 10 ml of distilled water was added, followed by 3-4 drops of concentrated sulphuric acid. The methyl esters of the oil were extracted with chloroform. The chloroform was then removed by evaporation.

Barminas et al. produced biodiesel (methyl ester and ethyl ester) from tiger nut (Cyper esculent us) oil by base catalyzed transesterification procedure as described by reported that fuel properties of esters meet the specifications for Jatropha methyl and ethyl esters used as biofuels in Nicaragua. It was found that ethyl ester of tiger nut oil had lower conradson carbon residue as compare to ethyl ester of Jatropha oil. et al. and a comparative study on catalyzed transesterification of soybean oil for biodiesel production with different acyl acceptors was conducted. Methanol has a serious negative effect on enzymatic activity. A molar ratio of methanol to oil of above 1:1 leads to serious inactivation of the enzyme. However, when methyl acetate was used as the acyl acceptor, a yield of 92% of methyl ester could be obtained with a molar ratio of methyl acetate to oil of 12:1, and methyl acetate showed no negative effect on enzymatic activity. Additionally, with crude soybean oil as the oil source and methanol as acyl acceptor, a much lower methyl ester yield was obtained than that with refined soybean oil, while with methyl acetate as acyl acceptor, an equally high yield of methyl ester (92%) was achieved for both soybean oils. Moreover, the by-product triacetylglycerol is an important Chemical with a higher value than glycerol. Four continuous processes were developed by Zhang et al. for production of biodiesel from virgin vegetable oil or waste cooking oil under alkaline or acidic conditions on a commercial scale. Detailed operating conditions and equipment designs were obtained for each process. From the technical assessment, all of these processes proved to be feasible for producing a high quality biodiesel product and a top-grade glycerin by-product under reasonable operating conditions. However, each process had its limitations

## III. SCOPE FOR FUTURE WORK

The experimental analysis it was found that the blends of Jatropha oil with diesel could be used with higher performance up to certain extent.

Analysis of composition of exhaust emission can be done with prolonged service with neat bio-diesel.

Performance of engine can be compared for various blends of biodiesel with neat diesel; present study is focused only to blend bio-diesel fuels.

By computation analysis performance parameters can be extrapolated and compared with experimental results.

Design changes can be studies and can be proposed after studying the problems encountered after prolonged service of engines with these alternate fuels. Emission studies can also be done.

## REFERENCES

[1] Ramadhas, A. S., Jayraj, S., and Muraleedharan C., 2004, "Use of vegetable oils as I. C. engine fuels – A review", Renewable Energy, (29), 727-742.

[2] Report of the committee on development of BIO-FUEL (2003), Planning commissions, Govt. of India.

[3] Srivastava A., and Prasad R., 2000, "Tryglycerides based diesel fuels", Renewable and Sustainable Energy Review, 4(2), 111-113.

[4] Kumar S., Gupta A. K., and Naik S. N., 2003, "Conversion of non-edible oil in to biodiesel", Journal of Scientific and Industrial Research, 62(1, 2), 124-132.

[5] Foidl N., Foidl G., Sannchez M., Mittelbach M. and Hackel S., Jatropha curcus L. as a source for the

 

productions of biofuels in Nicaragua, Bioresource Technology, (1996), 58, 77-82.

[6] Ramadhas A. S., Jayraj S., and Muraleedharan C., Use of vegetable oils as I. C. engine fuels – A review, Renewable Energy (2004), (29), 727-742.

[7] Bradshaw G. B., and Meuly W. C., Process of making pure soaps. U. S. Patent No. 2, 271, 619(1942).

[8] Bradshaw G. B., and Meuly W. C., Preparation of detergents, U. S. Patent No. 2, 360, 844 (1944).

[9] Kandpal J. B., and Madan M., Jatropha curcus: a renewable source of energy for meeting future energy needs, Renewable Energy, 1995, 6(2), 159-160

[10] Barminas J. T., Maina H. M., Tahir S., Kubmarawa D., and Tsware K., A preliminary investigation into the biofuels characteristics of tiger nut (Cyper esculent us) oil, Bioresource Technology, (2001), 79, 87-89.

[11] Meher L. C., Vidya Sagar D., and Naik S. N., Technical aspects of biodiesel production by transesterification- a review, Renewable and Sustainable Energy , (2004), 1-21.

[12] Du W., Xu Y., Liu D., and Zeng J., comparative study on lipase-catalyzed transformation of soybean oil for biodiesel production with different acyl acceptors, Journal of Molecular Catalysis B: Enzymatic, (2004), 30, 125-129.

[13] Knothe G., Analytical methods used in the production and fuel quality assessment of biodiesel, Transaction of ASAE, (2001), 44 (2), 193-200.

[14] Kumar M. S., Ramesh A., and Nagalingham B., An experimental comparison of methods to use methanol and Jatropha oil in a CI engine, Biomass and Bioenergy, (2003), 25, 309-318.

[15] Kumar M. S., Ramesh A., and Nagalingham B., Use of hydrogen to enhance the performance of a vegetable oil fuelled CI engine, International Journal of Hydrogen Energy, (2003), 28, 1143-1154.

[16] Forson F. K., Oduro E. K., Donkoh E. H., Performance of Jatropha oil blends in a diesel engine, Renewable Energy, (2004), 29, 1135-1145

[17] Sharma Gaurav, 2013, Experimental Investigation of Performance Parameters of Single Cylinder IC Engine using Mustard Oil, M. Tech. Dissertation report SRCEM, Morena.