Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 10, October-2016

A Review: Biodiesel from Castor & Karanja Oil

Abhijeet D. Sangle[1],
[1]Department of Mechanical Engineering,
SESGOIFOE, Diksal, Karjat.

Tushar Katratwar[2],
[2]Department of Mechanical Engineering,
YTIET, Chandhai,
Bhivpuri Road.

S. S. Deshmukh[3],
[3]Department of Mechanical Engineering,
PRMIET.

Shrikant Baste[4]
[3]Department of Mechanical Engineering,
NHITM, Thane.

***Abstract* - Biodiesel has become a key source as a substitution fuel and is making its place as a key future renewable energy source. As an alternative fuel for diesel engines, it is becoming increasingly important due to diminishing petroleum reserves and the environmental consequences of exhaust gases from petroleum-fuelled engines Rapid growth in industrialization of developing countries is resulting in increasing demand for new & ecofriendly energy sources. Depletion of petroleum resources has led to the search for alternative fuel which is renewable, biodegradable and easily available. To satisfy this demand biodiesel derived from different plants oils is comparatively better option. Vegetable oils can be used directly or blended with diesel to fuel diesel (CI) engines. Conversion of vegetable oils into fatty acid methyl ester by trans-esterification is the most convenient method of transforming vegetable oil to biodiesel. The proportional blends of Karanja and Caster can be used in existing Compression ignition engines without any modifications.**

Index Terms – Biodiesel, Karanja oil, Castor oil.

I. INTRODUCTION

During the last century, energy consumption has risen sharply due to a change in lifestyle and substantial population growth. Fossil fuels are limited in life and the rising cost of these fuels has led to alternative renewable energy sources that led to energy security and environmental protection. It is important to find alternative fuels to meet the energy requirements. India has great potential for the production of biodiesel from inedible vegetable oil seeds. Biodiesel from vegetable oil have a promising alternative fuel for diesel fuel because of its renewability, better quality lighting, the comparable energy content and a higher safety without modification of the engine.

mixtures based on the availability and relevance of consideration as an alternative fuel in dependence. Biodiesel is the formation of an alkyl ester of vegetable oil by the transesterification process. This process is in fact used saturated to remove plant oils and unsaturated fats. This form of oil alkyl ester is mixed with diesel fuel in compression ignition (diesel) for use with improved properties. Performance and emission parameters were the result of changes in fuel different proportions mixed with diesel and assessed for their feasibility.

Biodiesel is a diesel fuel replacement cleaner made from renewable natural resources burning, such as new and used vegetable oils and animal fat sources. As petroleum diesel, biodiesel can be used in engines with compression ignition or diesel engines. Biodiesel is mainly characterized by the viscosity, high calorific value, the value of the cetane number, cloud and pour points, distillation characteristic points, flash and combustion. Viscosity is the most important property of biodiesel because it affects the operation of the fuel injection, especially at low temperatures where the increase in viscosity affects the fluidity of the fuel. The heat efficiency of the fuel mixed with some significantly biodiesel is increased compared to pure diesel fuel. With the use of biodiesel fuel combined with the specific fuel consumption mixed due to the reduction of biodiesel calorific value compared to diesel fuel. Biodiesel has a higher value than that of diesel oil, cetane number and non-aromatic to 10% oxygen weight. Biodiesel Characteristics Emissions of particulate matter (PM), hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gas are reduced with respect to the clean diesel. [1-10]

I. LITERATURE SURVEY

The economic analysis shows that KARANJA oil biodiesel can be used without altering the existing engine in a diesel engine to lead to job creation and savings of vital currencies. Emissions in the diesel. CO emissions were somewhat higher for mixtures B20 and B40. HC emissions decreased to 12.8% pair B20 and B40 not 2.85% based on the full-load diesel. [1]

For Jatropha biodiesel mixed with diesel has been experimentally observed that a mixture of 50% diesel conventional combustible with50% Jatropha Biodiesel (B50) provides performance pure diesel not as (D100) comparable. A mixture of 80% diesel conventional & 20% Jatropha Biodiesel (B20) gives a good mechanical performance at full load. [2]

Most of the studies are based on the results of the study of the biodiesel process. Supports the use of biodieselto reduce emissions of carbon monoxide. The dominant view is that HC emissions are reduced when biodiesel blends are used instead of diesel. This reduction is due to the more oxygen content. [3]

The VARIO compression ratio (CR) for all CR braking efficiencies Termica's ester mixtures Karanja Oil Methyl Ester are very close to 20% and diesel are mixed with diesel, B20 provides maximum engine biodiesel operational efficiency. When the injection pressures up to 180 bars to 200 bar reduces emissions and increases performance. Most experiments were performed at a constant speed of 1500 rpm.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 10, October-2016

You can see that all UN experiments showed better performance and reduce harmful emissions. It can be seen that all experiments showed improved performance and reduced emission of harmful gases. Injection pressure of 200 bar and 16:1 compression ratio can be used as optimum values and CI engines can be run with karanja biodiesel. Mixtures of Karanja Oil Methyl Ester with diesel could replace up to 40 vol % diesel. It could replace the diesel to get lower emissions to run without sacrificing power and thus contribute to fight against air pollution in strongly. [4]

Diesel and castor oil methyl ester (diesel, B5, B15, B25, B50, B75, B100) combustible mixtures are used for the drive power and with respect to the load. Biodiesel can COME 25% blend with diesel from petroleum used in existing engines without modification. We can see with 75% pure diesel fuel that 25% pure mixed pure castor oil is the most suitable engine without heat melting and without rebuilding the engine. Castor oil can be used as an alternative to combustible diesel, cheap, abundant and relatively low emissions. [5]

Castor oil biodiesel requirements attended the ANP; Therefore, it will allow combustible Combat. Castor oil biodiesel has a higher viscosity inflammation and the extent that the diesel oil. A higher flash point ensures handling and storage safety. The NMR spectrum of castor oil glycerides present is one protonated to 4.2 ppm. The spectroscopic data biodiesel oxidative polymerization indicated deteriorated the thermal data confirm. Biodiesel degraded in 210 ° C 48 h, rubber formation has occurred, suggesting that the oxidative polymerization was completed. [6]

The physico-chemical properties of the *Pongamia pinnata* fatty acid methyl esters including specific gravity, kinematic viscosity, flash point, cloud point, water content, carbon residue, refractive index, copper corrosion and calorific value were 0.873, 4.6 mm2/s at 40° C, 178° C, 5° C, 0.012 vol. %, 0.033 mass %, 1.445, 1b and 3788 cal/gm respectively. The obtained values of physico-chemical properties are in accordance with the specifications of biodiesel as per ASTM D6751 standard. These results shows that the synthesized iron nanoparticles acted as a catalyst to produce biodiesel and the obtained biodiesel was considered as good alternative to the petroleum diesel. [7]

The effects of CNT nano additive addition on performance and emission with Castor Oil Methyl ester fuelled DI diesel engine at different loads has been studied and came to the conclusion that,(1) The brake thermal efficiency increases by 4.17 % and NO emissions reduces by 7.25 % for MENO+CNT200 blend compared to neat biodiesel. (2). The NO, HC, CO and smoke emissions were reduces by adding
nano additive to the neat biodiesel. (3). The performance parameter like brake thermal efficiency increases and brake specific fuel consumption decreases by adding nano additive[20]

After comparing with neat diesel CO emissions were slightly higher for B20 and B40 blends. Hydrocarbon emissions decreased by upto 12.8 % for B20 and 2.85% B40 compared to diesel at full load. Both blends tested result in a slightly reduced thermal efficiency and increased smoke, HC and CO levels. [8]

Nanocatalyst for biodiesel production significantly improves product performance. The most important nano-oxides used for biodiesel production are Zn, Ca, Mg and Cu. These were used separately or in support of different materials. However, other catalysts such as Li, Cs and KF can also be used for edible and non-edible oils. In addition, the magnetic nanoparticles have been functionalized with various catalysts in the production of biodiesel, which facilitates the recovery of the catalyst. [9]

Iron (II) doped ZnO catalysts prepared by co-precipitation processes have shown an effective catalytic activity for the transesterification of castor oil with methanol. All parameters such as reaction time, catalyst loading, temperature, time and the molar ratio of methanol to oil have a significant effect on the heterogeneous esterification of castor oil. The maximum yield of biodiesel from castor oil was 91% under optimum conditions: 50 minutes reaction time, 550 ° C temperature, 14% by weight of the oil and the catalyst molar ratio of methanol feed of 12: 1. The first order tends to change the kinetic model, When the activation energy found for 1527.53 J / mol found. [10]

II. MATERIALS AND METHODS

Certain edible oils such as, sunflower, cottonseed, rapeseed and palm can be used in diesel engines. For long life of the diesel engines these oils cannot be used directly. These oils are not cost effective to be used as an alternate fuel in diesel engines at present. Some of the non-edible oils such as mahua, castor, neem (*Azadiracta indica*), rice bran, linseed, Karanja (*Pongamia pinnata*), jatropha (*Jatropha curcas*) etc. can be used in diesel engines after some chemical treatment. [2]

A. Materials

1) Karanja (Pongamia Pinnata):

Botanical name Karanja Seed oil is the family Leguminaceae Pongamia glabra. Pongamia is widely distributed in tropical Asia and the oil is of Indian origin in the country. It is located in the main, northern Australia, Fiji, Western Ghats in India and parts of eastern Asia. The plant is also said to be very tolerant of salinity and can know in different textures of soil type. Rocky, sandy and loamy. Karanja can grow in subtropical moist environments, Come with annual rainfall varies between 500 and 2500 mm. This is one of the reasons for the widespread availability of Plant these species. The tree wears green pods, which after about 10 months to change a not tan. The son of a flat elliptical, 5-7 cm long and contain 1 or 2 as brownish red beans. Grain yield per tree A signals from 8 to 24 kg. Removing bean son pests white and covered with a thin reddish skin. The composition of the dried beans is the humidity of the air, typical 19%, oil 27.5% and 17.4% protein. Karanja The actual production of oil is about 200 million tons per year. The required time for the shaft Varia maturity 4-7 The years of the size and the wave with corpuscles yield each of 8 to 24 kg. The oil is used by ordinary people because of their low cost and easy availability. [3-4]

II) *Castor (Ricinus communis):*

The castor, ricinus communis, is a species of flowering plant in the wolf's milk, Euphorbiaceous family. Castor is native to the Mediterranean Basin, East Africa and India. Castor seed

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 10, October-2016

is the source of castor oil, which has a wide variety of uses. Castor's reasonable advantage is that the growth period is much shorter than that of Jatropha and Karanja and are not far mid mayors of experience and awareness of the farmers on their plows. Growing, shrubs permanence cheating the size of a trivial tree can measure (about 12 subways / 39) cakes.

The seeds contain between 40% and 60% of oil, which is rich in triglycerides, main ricinoleína. Son seminal ricin toxin, which is also present in small concentrations along the plant. Premiums castor toxicity due to the occurrence of ricin, a toxic substance. The toxin has the castor with a degree of natural protection against harmful insects. Castor grows well in hot and humid tropical conditions and over a period of 4 to 5 months of growth. Castor oil is a light yellow, colorless liquid with no light or no odour or taste. Castor oil has a very low fog and Fourth points which will make the drying oil no Duro this good alternative biofuel conditions. It will do in the winter neither cured or thin excessive heat cold, so even Common used lubricant for cars and jet engines race. [5-6]

III)Catalyst:

Catalyst plays an important role in the production of biodiesel, which improves the reaction rate and high performance tranesterifications process producing high yield biodiesel. Alkali Catalysts such as Potassium Hydroxide(KOH), Sodium Hydroxide(NaOH), Sodium Methoxide, Potassium Methoxide, and Homogeneous acid catalysts come from strong mineral acids, p-toluene sulfonic acids most commonly used in the manufacturing process, industrial biodiesel. The transesterification of homogeneous catalyst generate saponification, however, and therefore requires post-process procedures to remove homogeneous catalysts that reflect the high production costs. However, heterogeneous catalysts are zeolites and ion exchange resins come have many advantages that non-corrosive, easy separation and require no washing of the ester. The disadvantage of biodiesel produced by heterogeneous catalyst gives low yield of product and disposal problems. [7]

B. Transesterification Process

The transesterification procedure was conceded out in two steps: 1. acid esterification and 2. the base esterification process. The acid esterification process was used to reduce the FFA of the particular oils up to 1-2% as they have additional acid than the 4 mg KOH/gm. The first step was carried out at a temperature range of 50-60oC with 200 ml methanol and 0.5% v/v H_2SO_4. A 4 ml sample of methanol was taken from the flask at 15 min intervals and the process carried out until the FFA level reduced. Sulphuric acid and excess alcohol with impurities was removed after pouring the product into a separating funnel.

The lower layer was collected from the separating funnel for the base transesterification process. During the transesterification process, 1% KOH (catalyst) dissolved in 25% v/v methanol was poured into the flask. The mixture was heated at a constant temperature of 70°C and stirred at 700 rpm for 3 hours. The mixture was then poured into a separating funnel where two layers formed.

The upper layer had methyl esters of vegetable oils and the bottom layer contained glycerol and impurities. The upper layer formed was washed by hot distilled water two to three times so that the catalyst and ethanol could be removed. Moisture from the biodiesel was removed by drying at 90-100°C under vacuum and passing the layer over anhydrous sodium sulphate. The shriveled oil was taken for performance and emission measurement. [8]

C. The technology of Nano Particles

Nanoparticles are of countless concentration since they act as association gap among the atomic/molecular structure to the material in bulk as they exhibit totally new or enhanced properties based on specific characteristics such as size, shape, distribution, ionic strength, capping agent and morphology.[11,12] When well characterized bulk material was comparatively studied with Nanoparticles it was detected that nanoparticles due to their extremely small size and large surface area possess[16,17] many interesting properties (e.g.: Mechanical properties, biological & ironic properties, catalytic activity, thermal & electrical conductivity, optical absorption and melting point) at same chemical composition.[12-19] Nanomaterial has grew exceptional attention as a catalyst for biodiesel production, paid to its large specific surface area, high catalytic activity, high resistance to saponification and good rigidity. In nanocatalyzed transesterification process, KF treated nano Al_2O_3 catalyst used to produce biodiesel from canola vegetable oil with the conversion of 97.7%. The transesterification using soyabean oil and methanol was catalyzed by zirconia nanoparticles loaded with potassium bitartrate for the production of biodiesel. Biodiesel yield of 95.2% obtained using Nano catalyst derived from hydrotalcites with Mg/Al for the jatropha oil. [7]

In the production process of biodiesel transesterification reaction between the triglycerides and alcohol in the presence of a catalyst for the preparation of monoesters. Triglyceride molecules are mono- and glycerol. Transesterification process comprises a sequence of three reversible reactions. Convert triglyceride diglycerides, monoglycerides and diglycerides of glycerides occur molecule glycerol ester at each step. The oil and transesterification reaction of the alcohol with a homogeneous catalyst is the general process for the production of biodiesel. However, if homogeneous catalysts cause many defects, such as large amounts of water, product isolation problems, and environmental pollution caused by waste liquid. A method " green " based on heterogeneous catalysts is a new trend in the development of biodiesel. The biodiesel synthesis of solid catalysts instead of homogeneous use could possibly lead to lower production costs due to the reuse of the catalyst and the possibilities so that in a continuous fixed bed procedure to operate heterogeneous catalytic methods are generally resistant transfer of mass, time and ineffective. Despite the solid phase of intensive catalytic methods, industrial applications are limited. This suggests that more research is needed to solve the current problems. Nanocatalysts have a high surface area and high catalytic activities, the above-mentioned problems can be solved. A number of researchers have investigated the production of nanoscale heterogeneous catalysts to increase the catalytic activity. It is obvious that the large surface, which is a characteristic nanomaterial, increases the number of base stations and acid catalyst. [9]

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 10, October-2016

IV. EXPERIMENTAL WORK

The karanja oil and castor oil are used to extract biodiesel. The biodiesel is blended with petroleum diesel in different proportions to prepare testing blends which are tested on 4 stroke CI engine. The study of performance and emission characteristics of CI engine will be carried out.

V. CONCLUSION

From the study of literature, it is concluded that biodiesel blends in different concentrations can easily be used to provide alternative fuels to diesel.

A held an experimental research to sightsee the use of biofuels performance by using Castor and Karanja oil in diesel engine and reports on the results.

REFERENCES

[1] Nagarhalli M. V., Nandedkar V. M. and Mohite K.C. Karanja biodiesel and its blends in a C.I. engine and it's economics. AJEAS. Feb 2010.
[2] Shashi Kumar Jain, Sunil Kumar, and Alok Chaube. Technical Sustainability of Biodiesel and Its Blends with Diesel in C.I. Engines: A Review. IJCEA. April 2011.
[3] M.P.Sudesh Kumar, B.Shunmuga Raj, D.Venkatakrishnan, J.Sai Kiran. Vegetable derived biodiesel fuel as an alternate fuel for diesel engines- a review. ICRAMET. 2015
[4] Raghavendra Prasada S.A., K. V. Suresh. Pongamia Pinnata (karanja) Biodiesel as an Alternative fuel for Diesel Engine: A Review. AEAS-URJ. 2014.
[5] R.Sattanathan. Production of Biodiesel from Castor Oil with its Performance and Emission Test. IJSR. 2013.
[6] Marta M. Conceicüa, Valter J. Fernandes et al. Thermal and Oxidative Degradation of Castor Oil Biodiesel. Energy & Fuels-ACS. 2007.
[7] Mookan Rangasamy, Krishnasamy Anbalagan, Sundaresan Mohanraj,Velan Pugalenthi. Biodiesel Production from Pongamia pinnata Oil using Synthesized Iron Nanocatalyst. IJCR. Sept. 2014.
[8] Singh Y., Singla A. Comparative analysis of jatropha and karanja-based biodiesel properties, performance and exhaust emission characteristics in an unmodified diesel engine. Pollution 1(1): 23-30. Winter 2015.
[9] Mandana Akia1, Farshad Yazdani et al. A review on conversion of biomass to biofuel by nanocatalysts. BRJ. 2014.
[10] G. Baskar, S. Soumiya. Production of biodiesel from castor oil using iron (II) doped zinc oxide Nanocatalyst. Renewable Energy. 2016.
[11] R.R.Bhosale, et al. (2013). "Innovative Eco-friendly approaches for green synthesis of Silver Nanoparticles." International journal of Pharmaceutical Sciences and Nanotechnology **7**(1): 2328-2337.
[12] Ahmed, S., et al. (2015). "A review on plants extract mediated synthesis of silver nanoparticles for antimicrobial applications: A green expertise." Journal of Advanced Research
[13] Chandran, S. P., et al. (2006). "Synthesis of gold nanotriangles and silver nanoparticles using Aloe vera plant extract." Biotechnol Prog **22**(2): 577-583.
[14] Iravani, S. (2011). "Green synthesis of metal nanoparticles using plants." Green Chemistry **13**(10): 2638.
[15] Bogunia-Kubik, K. and M. Sugisaka (2002). "From molecular biology to nanotechnology and nanomedicine." Biosystems **65**(2-3): 123-138.
[16] Daniel, M.-C. and D. Astruc (2004). "Gold Nanoparticles: Assembly, Supramolecular Chemistry, Quantum-Size-Related Properties, and Applications toward Biology, Catalysis, and Nanotechnology." Chemical Reviews **104**(1): 293-346.
[17] Panigrahi, S., et al. (2004). "General method of synthesis for metal nanoparticles." Journal of Nanoparticle Research **6**(4): 411-414.
[18] Zharov, V. P., et al. (2005). "Self-assembling nanoclusters in living systems: application for integrated photo-thermal nanodiagnostics and nanotherapy." Nanomedicine: Nanotechnology, Biology and Medicine **1**(4): 326-345.
[19] Benjamin, G. and S. Bharathwaj (2011). biological synthesis of silver nano particles from Alliumcepa (onion). International conference on Biosciences,Biochemistry and Bioinformatics, IPCBEE. **5:** 35-38
[20] G.Balaji and M.Cheralathan(2015)" Effect of CNT as additive with biodiesel on the performance and emission characteristics of a DI diesel engine" International Journal of ChemTech Research ISSN: 0974-4290, Vol.7, No.3, pp 1230-1236.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)