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Biodiesel from Jatropha as alternative source of fuel

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Abstract: The depletion of world petroleum reserves & the increased environmental concerns have stimulated the search for alternative sources for petroleum based fuel, including diesel fuel, because of closer properties. Biodiesel fuel (fatty Acid methyl ester) from Jatropha is considered as the best of the applicant for diesel fuel alternate in diesel engines. It is made from renewable biological sources. It consists of the monoalkyl esters formed by a catalyzed reaction of the triglycerides in the oil or fat with a simple monohydric alcohol. Diesel engines operated on biodiesel have lower emissions of carbon monoxide, unburned hydrocarbons, particulate matter, and air toxics than when operated on petroleum-based diesel fuel [1]. Biodiesel fuel (fatty Acid methyl ester) from Jatropha is considered as the best of the applicant for diesel fuel alternate in diesel engines [1].

KEYWORDS: - Bio-fuel, Jatropha,

I .INTRODUCTION

Biodiesel can be produced from vegetable oil, animal oil/fats, tallow and waste cooking oil. The process used to convert these oils to Biodiesel is called transesterification. Studies have shown that vegetable oils can be used in diesel engines as they are found to have properties close to diesel fuel. It is being considered a breakthrough because of availability of various types of oil seeds in huge quantities. Vegetable oils are renewable in nature and may generate opportunities for rural employment when used on large scale.Fossil fuels are one of the major sources of energy in the world today. Their popularity can be accounted to easy usability, availability and cost effectiveness. But the limited reserves of fossil fuels are a great concern owing to fast depletion of the reserves due to increase in worldwide demand. Fossil fuels are the major source of atmospheric pollution in Today's world. So efforts are on to find alternative sources for this depleting energy source.

Renewable energy from biodiesel replaces conventional fuels in four distinct areas: electricity generation, hot water/ space heating, motor fuels, and rural (off-grid) energy services. Bio-fuels include a wide range of fuels which are derived from biomass. The term covers solid biomass, liquid fuels and various biogases. Liquid bio-fuels include bio-alcohols, such as bio-ethanol, and oils, such as biodiesel. Biodiesel is made from vegetable oils, animal fats or recycled greases. Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles.

Biodiesel is renewable source of energy is as efficient as petroleum diesel in powering unmodified diesel engine. Biodiesel is an alternative fuel for diesel engines that is produced by chemically reacting a vegetable oil or animal fat with an alcohol such as methanol, chemically reacting lipids, soybean oil, canola or hemp oil, consisting of long-chain alkyl (methyl, propyl or ethyl) esters can be produced through a simple transesterification process. The reaction requires a catalyst, usually a strong base, such as sodium or potassium hydroxide, and produces new chemical compounds called methyl esters also know as biodiesel [1]. There are at least four ways in which oils and fats can be converted into Biodiesel transesterification, Blending, micro emulsions, Pyrolysis.Bio-fuel provided 2.7% of the world's transport fuel. Diesel can also be used as a low carbon alternative to heating oil [2].

The impurities contained in crude biodiesel include free fatty acids, water, methanol, glycerides, free glycerin, and metal compounds such as soap and catalyst. Saka and Kusiana [3–7] claim that it is possible to react the oil and methanol without a catalyst, which eliminates the need for the water washing step. The purity of the final product needs to be fully characterized, and formation of non methyl ester compounds in significant amounts is possible. Dasari et al. [6] measured reaction rates without catalysts at temperatures of 120 8C to 180 8C. [4, 8] and attributed it to catalytic effects at the surfaces of the reaction vessels and noted these effects would be exacerbated at higher temperatures. [5].Kreutzer [9] has described how higher pressures and temperatures
(90 bar, 240 8C) can transesterify the fats without prior removal or conversion of the free fatty acids.

Applications

Can be used in pure form or may be blended with petroleum diesel at any concentration in most injection pump diesel engines. New extreme high-pressure (29,000 psi) common rail engines have strict factory limits of B5 or B20, depending on manufacturer.[citation needed] Biodiesel has different solvent properties than petro diesel, and will degrade natural rubber gaskets and hoses in vehicles (mostly vehicles manufactured before 1992), although these tend to wear out naturally and most likely will have already been replaced with FKM, which is nonreactive to biodiesel. Biodiesel has been known to break down deposits of residue in the fuel lines where petro diesel has been used. As a result, fuel filters may become clogged with particulates if a quick transition to pure biodiesel is made [9].

Advantages of Biodsel

Biodiesel is environmentally friendly:

Biodiesel is nontoxic, biodegradable. It reduces the emission of harmful pollutants from diesel engines (80% less CO2 emissions, 100% less sulfur dioxide) .

Biodiesels are more available

It was stated that about half of the biodiesel industry can use recycled oil or fat, the other half being soybean, or rapeseed oil according to the origin of these feed stocks.

Biodiesel cleans the engine & increases engine life: The use of biodiesel can extend the life of diesel engines because it is more lubricating and, furthermore, power output are relatively unaffected by biodiesel. Biodiesel helps lubricate the engine by reducing wear: Blends of 20% biodiesel with 80% Petroleum diesel can be used in unmodified diesel engines.

Biodiesel is more biodegradable than conventional diesel: Biodiesel has a high cetane number. The high cetane numbers of biodiesel contribute to easy cold starting and low idle noise. Biodiesel is non-toxic & has a higher flashpoint than conventional diesel fuel Bio fuel not only reduces pollution, but can help clean it & Bio fuels can reduce a lot of waste

II METHODS OF PRODUCTION:

OIL EXTRACTION

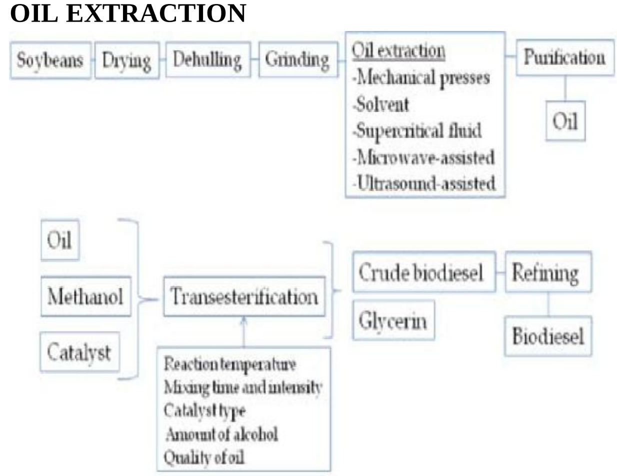

Figure 1: Oil Extraction procedure from soybeans:

A) The separation of the soybean into oil is done by crushing, using mechanical extruders. Commonly the oil is extracted from the soybeans using chemical hexane extraction (figure.1).

B) Natural gas and process steam are used to provide heat for drying.

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C) The de hulled beans or meats are conditioned by heating, cut into flakes, and fed to the oil extraction unit where the oil from the beans is dissolved with hexane. The oil and hexane mixture is treated with steam to separate the hexane from the oil. Once the hexane is removed, it is recycled for additional

D) Processing Hot air and cooling water are used in the final heating and drying of the oil. The crude soybean oil is degummed and may be deodorized, bleached, and neutralized. The oil-depleted, dried soybeans are ground to a uniform size to make soybean meal. [10]

III.CONVERSION OF SOYBEAN OIL IN TO

BIODIESEL

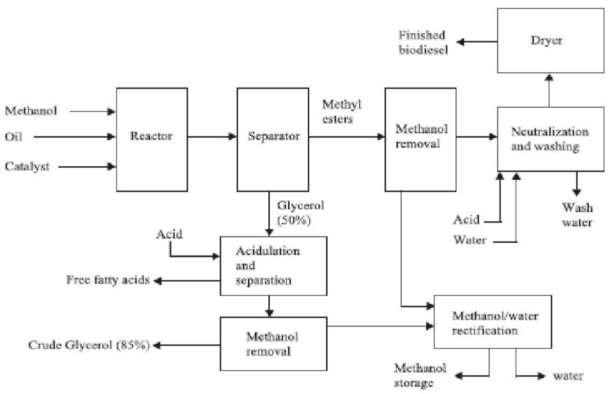


Fig. 2. Process flow schematic for biodiesel production.

Figure 2: Conversion of Jatropha to Biodesel

1) The conversion of soybean oil into biodiesel is done by reacting, the oil with an alcohol, usually methanol, and a catalyst, such as sodium hydroxide, in large reactors.

2) After the soybean oil, methanol, and catalyst have reacted, the resulting mixture is centrifuged to remove excess methanol, glycerin, and other impurities. After the centrifuge step, the mixture is then washed with a water acid solution and dried to become a methyl ester, which is commercially known as biodiesel (figure 2).

3)The stream of methanol, glycerin, and other impurities is then treated with a small amount of acids and bases to remove any remaining fatty acids. This can be accomplished by breaking down triglyceride bonds, with the final product being referred to as biodiesel. The remaining material is then distilled to recover the methanol and most of the water.

4) The excess methanol and water are recovered and reused to avoid waste and reduce input costs [12].

Products from Biodiesel Preparation Process:

Biodiesel is a proven alternative to petroleum diesel fuel. Once produced; biodiesel contains several impurities such as soap and glycerin. The free fatty acids in the oil react with the sodium or potassium catalyst to form soaps. After the biodiesel and by product glycerin are separated, trace amounts of glycerin remain in the biodiesel. Glycerin is used in the production of various other products, including fiberglass resin, cosmetics, pharmaceuticals, liquid laundry detergents, soaps, deicers, and antifreeze.

Electrical energy is used to drive the pumps, centrifuges, and mixers, while thermal energy is needed in the distillation column to recover the excess methanol and remove the final rinse water from the biodiesel.

Thermal energy is also used to heat the soybean oil to accelerate the conversion process. The conversion of the soybean oil into biodiesel, the recovery of the excess methanol, and the treatment of the glycerin requires 18,772 Btu per gallon of biodiesel [13].

IV. PRODUCTION OF BIODIESEL:

Quantity:

1000 ml of soyabin oil+ 15 gm Potassium hydroxide

(KOH)+ 120 ml methanol ($CH3OH$))

Density of methanol=0.789

Procedure:

Step 1:- Keep temperature 100 ◦C, stirrer it & when temperature comes to 100 ◦C then stirrer it for 45 min & switch off a heater. & maintain temperature 100 ◦C by cooling.

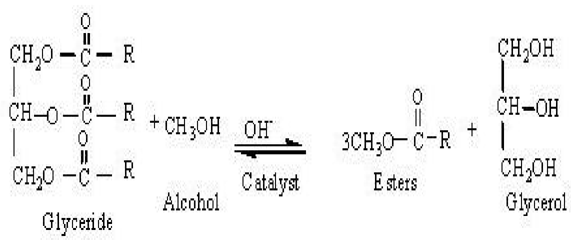
Step 2:- After 45 min. decrease temperature up to 65 ◦C. Now maintain temperature 70 ◦C for 15 min. by cooling.

Step 3:- Now add 5 gm of KOH+ 50 ml of methanol.

Step 4:- Again increase temperature up to 70 ◦C, for 15 min. & stirrer it.

Step 5:- Add 13.5 ml of water+ 1.5 ml Hydrochloric acid (HCL) (water: HCL =1:9)

Step 6:- Final Product Biodesel+ Glycerin



V. DETAILED SPECIFICATION OF TEST RIG

1. ENGINE
a. MAKE – Brand New Assemble Engine
b. Speed – 1500 RPM with Governor Mechanism
2. ELECTRICAL DYNAMO METER – An AC alternator is coupled to the engine connected with load bank.
3. AIR INTAKE MEASUREMENT – Air Intake fitted with orifice and water manometer.
4. FUEL INTAKE MEASUREMENT – Calibrated burette arrangement fitted on the control panel to measure the fuel Consumption with two numbers. Ball Valve to control and measure the quantity of fuel consume.
5. EXHAUST GAS CALORIMETER – Water cooled gas calorimeter shell and coil type to study the heat lost to exhaust gases. Water flows inside the copper tubes and exhaust gases flows into the shell.
MULTI CHANNEL TEMPRATURE INDICATOR – For measuring inlet and outlet temperature of exhaust gases and
Water fall engine cooling jacket and calorimeter with Cr-Al Thermocouples.

Figure 3: Process engine
1.Water inlet temperature – To engine and calorimeter
2.Water outlet Temperature – To engine
3.Water outlet Temperature – To calorimeter
4.Exhaust gas inlet temperature – To Calorimeter
5.Exhaust Gas Outlet Temperature – To Calorimeter
6.Ambient Temperature

RESULT

ENGINE PERFORMANCE
ENGINE PERFORMANCE PARAMETER AT 100% DIESEL
DENSITY = 0.87

THE OBSERVED ENGINE PERFORMANCE USING DIESEL AND BIODIESEL

Performance	Diesel	Biodiesel	50% Biodiesel & 50% Diesel
Brake power , kw	0.466	0.895	0.339
Specific fuel consumption, g/kw-hr	784	629.74	1298
Mass of fuel, kg/hr	0.712	0.62	0.44
Brake thermal efficiency,%	11.76	24.09	10.8
Mass of air, kg/hr	7.94	5.52	8.49
Air fuel ratio	31.15	8.9	19.3

THE OBSERVED PROPERTIES OF OIL AND FUELS

Properties	Jatropha Oil*	Biodiesel	50% Biodiesel & 50% Diesel	Diesel*
Density [gm/cc]	--	0.62	0.58	0.84
Kinematic viscosity at 30°C	55	5.34	6.86	4.0
Calorific value [MJ/kg]	39.5	41	42.7	45
Cetane number	43	--	--	47
Solidifying point °C	-10	--	--	-14
Boiling point °C	286	255	--	248

VII. CONCLUSIONS:

Biodiesel is Renewable source of energy is as efficient as petroleum diesel It can be produced from many vegetable oil or animal fat feedstock. Conventional processing involves an alkali catalyzed process, but this is unsatisfactory for lower cost high free fatty acid feedstock

due to soap formation. Pretreatment processes using strong acid catalysts have been shown

to provide good conversion yields and high-quality final products. This method of production gives maximum efficient fuel which is in pure form. These techniques have even been extended to allow biodiesel production from feedstock like soap stock that are often considered to be waste. Thus Biodiesel plays important role in transportation fuel.

VIII. REFERENCES

1) .http://en.wikipedia.org/wiki/Renewable_energy.

2) Jon Van Gerpen." Biodiesel processing and production", University of Idaho, Moscow, ID 83844, USA, Fuel Processing Technology 86 (2005) 1097– 1107.

3) A. Pradhan,D.S. Shrestha ,A. McAloon ,W. Yee ,M. Haas ,J.A. Duffield ,H. Shapouri,"Energy Life-Cycle Assessment of Soybean Biodiesel", United States ,Department of Agriculture,Agricultural Economic Report Number 845 September 2009.

4) S. Saka, K. Dadan, Transesterification of rapeseed oils in supercritical methanol to biodiesel fuels, in: R.P.Overend, E. Chornet (Eds.), Proceedings of the 4th Biomass Conference of the Americas, Oakland, CA, 1999 (Aug. 29–Sept. 2).

5) S. Saka, D. Kusdiana, Biodiesel fuel from rapeseed oil as prepared in supercritical methanol, Fuel 80 (2001) 225–231.

6) D. Kusdiana, S. Saka, Kinetics of transesterification in rapeseed oil to biodiesel fuel as treated in supercritical methanol, Fuel 80 (2001) 693–698.

7) M.A. Dasari, M.J. Goff, G.J. Suppes, Non-catalytic alcoholysis kinetics of soybean oil, JAOCS 80 (2003) 189–192.

8) Y. Warabi, D. Kusdiana, S. Saka, Reactivity of triglycerides and fatty acids of rapeseed oil in supercritical alcohols, Bioresour. Technol. 91 (2004) 283– 287.

9) M. Diasakou, A. Louloudi, N. Papayannakos, Kinetics of the non-catalytic transesterification of soybean oil, Fuel 77 (1998) 1297– 1302.

10) U.R. Kreutzer, Manufacture of fatty alcohols based on natural fats and oils, JAOCS 61 (2) (February 1984) 343–348.

11) W. Zhou, S.K. Konar, D.G.B. Boocock, Ethyl esters from the single-phase base-catalyzed ethanolysis of vegetable oils, JAOCS 80 (2003) 367– 371.

12) D.G.B. Boocock, Single-phase process for production of fatty acid methyl esters from mixtures of triglycerides and fatty acids, Canadian Patent No. 2,381,394, Feb. 22, 2001.

13) D.G.B. Boocock, S.K. Konar, V. Mao, C. Lee, S. Buligan, Fast formation of high-purity methyl esters from vegetable oils, JAOCS 75 (1998) 1167– 1172.