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A Review on Honge is an Alternate Biodiesel

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ABSTRACT: The increasing demand for traditional fuels, their rising costs and their impact on environmental pollution make it necessary to find alternative energy sources. The world's fuel reserves are depleted every day, and modern scientists are facing the problem of finding alternative fuels. ... Biodiesel is an alternative fuel for diesel engines and has attracted worldwide attention. Its main advantage is that it is one of the cheapest renewable fuels, non-toxic and biodegradable, which makes it a suitable substitute for most diesel engines without major modifications. To the engine. Biodiesel is a kind of renewable fuel produced by the country, which can be used as raw materials for producing biodiesel, such as vegetable oil, non-edible oil, and animal fat. Its purpose is to provide a detailed overview of the production of biodiesel from Pongamia pinnata oil, its various characteristics, performance and emissions in compression ignition engines (CI), and its applicability as an alternative fuel for diesel engines. The storage time of red grid biodiesel should not exceed six weeks to prevent fuel deterioration characteristic.

KEYWORDS: Conventional fuel, biodiesel, Pongamia pinnata, alternate fuel, diesel engine, blend, transesterification, emissions

I. INTRODUCTION

Diesel motor burns inside the motor which utilizes warmth pressure for starting and consume the fuel which as been infused for the ignition chamber. They initially utilized more proficient substitution for fixed steam motor since the starting point of the submarines, ships, trains (like auto, truck) hefty gear and furthermore in power age plants. Different vegetable oils have both palatable and also non consumable is considered as a elective hotspot for an diesel motor. The majority of an created nations sunflower, nut and few of them are utilized as a elective source are consumed by the Indian setting[1]. Accordingly agricultural nations, its alluring for delivering biodiesel from an non consumable oil which is broadly filled in waste terrains to the country. The utilization of fuel for the motor is more on the street and rough terrain vehicles that has been developed dramatically and keeps on doing as such, the fuel used in the diesel motor is Diesel, The motor starts because of the pressure of air blend and influsion of fuel. Fuel (Diesel) has been started from the test led by an Germany researcher and also designer Rudolf Diesel for the pressure started motor as his imagination, Through the different sources like oil, biomass, creature fats, biogas, petroleum gas, coal diesel was created[2]. It have been accounted for that a non eatable oils accessible for Indians is pongamia and jathropa elastic Seeds and so on anyway the significant hindrance of vegetable oil as theirs thickness. The diesel(fuel) influsion framework is diesel motor is more delicate for more consistency change, more consistency of an vegetable oil prompts helpless atomization. Thistly prompts helpless burning, ring staying, injector coking, injector stores, injector siphon disappointment and greasing up oil weaking by wrench case polymerization[3].

II. BIO DIESEL

A. Need for Biodiesel:

The utilization of the oil rose from an 2000 millions tons to 4500 millions tons each Year the cost of unrefined petroleum in worlds markets went up to 20 US dollars per barrel, the examiners expects more oils cost for long haul. India vehicular populace assessed for having increment multiple time in course of recent many years contributing about 243.3 million tons of fossil fuel by-products internationally, 65 millions metric tons of diesel is utilized in India. In the planet with regards to non-renewable energy source utilization India ranks at fifth position. considering rising costs, the climate and environmental change concerns, nations everywhere on the world have dispatched biodiesel projects to create options in contrast to customary fuel[4].

B. Why Pongamia pinnata and its oil?

Different elective biodiesel choices attempted instead Hydrocarbon oil fundamentally biogas maker Ethanol, Methanol and also vegetable oil. More over vegetable oil offer more benefits on account of an tantamount Fuel. Yet because of developing populace, expanding pace of utilization and expanding the capita and pay interest for a eatable oil in India speeding up prompting expanded expanse and deficiency of supply. This squeezes the utilization of eatable oils hotspot for an biodiesel[5].

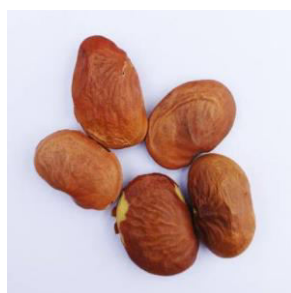


Fig 1. Seed of Pongamia

Pongamia pinnata is one of the best trees species having a place with group of leguminaceae for which it is appropriate for giving oils to biodiesel creations; it may adjust for global guidelines. Honge is the best timberland base tree non palatable oils with a creation capability of 135000 metric tons each Year in India. It can even be filled with salt water and can withstand harsh weather conditions with a temperature range of 0-50°C[5]. The annual rainfall is also 5-25 dm. The oil content is about 30-40%. It is estimated that it is a fast-growing tree, about 40 feet tall. The flowers are pink, light purple or white. The flowers are round, 3-6 cm long, 2-3 cm wide, with thick walls, and usually contain a single seed. The seeds are 10-15 mm long, oval in shape, and shallow soil. A thick, unpleasant orange-yellow to brown oil is isolated from the seeds. It is usually used for tanning calfskin, clarifying and brightening oils, and also as a film for ointments, watercolours and insecticides. This oil has been tested as a fuel for diesel engines and has shown comparable competitiveness with diesel in terms of heat equivalent. The characteristic ratio of water, butter and diesel. Since the consistency of water butter can cause problems such as suction and spraying, it is important to reduce the consistency through transesterification[6].

Properties of Pongamia oil and neat diesel			
Sl. No.	Properties	Pongamia oil	Diesel
1	Flash point (°C)	263	49
2	Specific gravity	0.912	0.83
3	Acid value (mg/KOH)	1.52	-
4	Kinematic viscosity (mm ² /s)	41.06	2.4
5	Kinematic viscosity after TES	5.6	-
6	Calorific value (MJ/kg)	34	41.86

Table 1. Properties of Pongamia and neat diesel(ref.)

III. METHODS AND METHODOLOGY

The arrangement of methyl esters by transesterification of vegetable oils requires 3 moles of liquor stoichiometrically. Anyway it is a balance response where overabundance liquor is needed to drive the response near culmination. The

vegetable oil was synthetically responded with a liquor within the sight of an impetus to deliver vegetable oil esters[7]. Glycerol was created as a side-effect of transesterification response. The combination was mixed ceaselessly and afterward permitted to settle under gravity in an isolating channel. Two particular layers will shape after gravity settling. The upper layer of ester and the lower layer of glycerol. The lower layer was isolated out. The isolated ester was blended in with warm water to eliminate the impetus present in the ester and permitted to settle under gravity. The impetus gets isolated. After transesterification measure, the consistency of the Pongamia oil was discovered to be diminished to 5.6 mm²/sec from 41.06 mm²/sec which is closer to the diesel esteem as given in the Table-1. Arranged Pongamia ester was then mixed with mineral diesel in different focuses for getting ready biodiesel mixes to be utilized in CI motors for directing different motor tests.

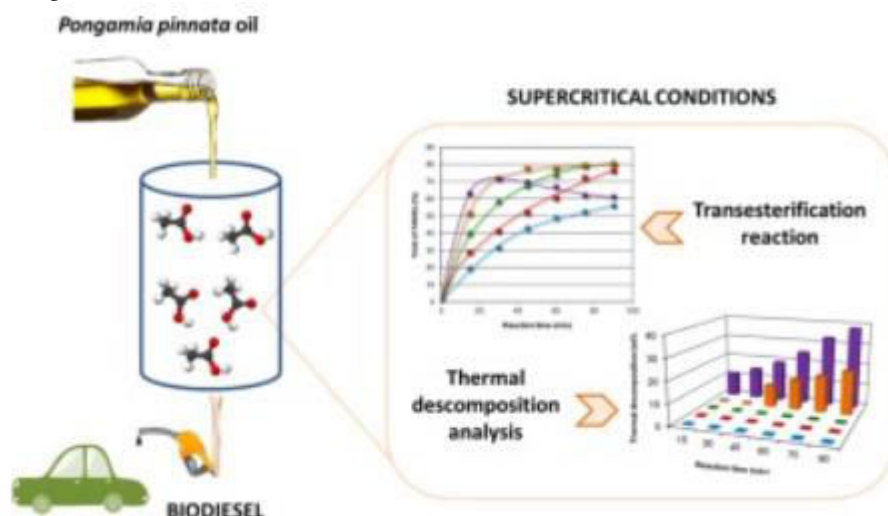


Fig 2. Transesterification process

Pongamia pinnata is one of the best trees species having a place with group of leguminaceae for which it is appropriate for giving oils to biodiesel creations, it may adjust for global guidelines. Honge is the best timberland base tree non palatable oils with a creation capability of 135000 metric tons each Year in India.). It can even be filled with salt water and can withstand harsh weather conditions with a temperature range of 0-50°C. The annual rainfall is also 5-25 dm. The oil content is about 30-40%. It is estimated that it is a fast-growing tree, about 40 feet tall. The flowers are pink, light purple or white. The flowers are round, 3-6 cm long, 2-3 cm wide, with thick walls, and usually contain a single seed. The seeds are 10-15 mm long, oval in shape, and shallow soil. A thick, unpleasant orange-yellow to brown oil is isolated from the seeds. It is usually used for tanning calfskin, clarifying and brightening oils, and also as a film for ointments, water colors and insecticides[8]. This oil has been tested as a fuel for diesel engines and has shown comparable competitiveness with diesel in terms of heat equivalent. The characteristic ratio of water, butter and diesel. Since the consistency of water butter can cause problems such as suction and spraying, it is important to reduce the consistency through transesterification. Water butter has a very high consistency and can directly replace diesel. Due to the interaction of the transesterification, the consistency deteriorates. Basically, Karanja is a medium-sized, fast-growing evergreen plant with a height and width of up to 12 meters, with a wide hiding place on both sides, providing moderate shade. It is one of three different nitrogen fixing agents. Compared with biodiesel Mahua, Sesame and Kusum, Karanja prefers relaxation and running characteristics.

3. Brake thermal efficiency

The combination was mixed ceaselessly and afterward permitted to settle under gravity in an isolating channel. Two particular layers will shape after gravity settling. The upper layer of ester and the lower layer of glycerol[9]. The lower layer was isolated out. The isolated ester was blended in with warm water to eliminate the impetus present in the ester and permitted to settle under gravity. The impetus gets isolated. After transesterification measure, the consistency of the Pongamia oil was discovered to be diminished to 5.6 mm²/sec from 41.06 mm²/sec which is closer to the diesel esteem as given in the Table-1. Arranged Pongamia ester was then mixed with mineral diesel in different focuses for getting ready biodiesel mixes to be utilized in CI motors for directing different motor tests [9].

3.2. Brake specific energy consumption

The best mixed BSEC variant for three different compression ratios. It can be seen that the BSEC with a compression ratio of 18 is smaller than the other two. At higher compression ratios, the energy demand per kilowatt is lower than at lower compression ratios. Figure 5 shows the changes in BSEC for different mixtures at full load. The BSEC value of biodiesel blends is slightly higher than that of diesel fuel. This may be due to the lower calorific value of Red River methyl ester compared with diesel. BSEC B20 runs lower than other mixtures, indicating that the 20% mixture is the best mixture for thermal efficiency and BSEC[10].

3.3. Exhaust gas temperature

The exhaust gas temperature range of the B20 with chimney will increase with increasing diesel fuel load at the three pressure levels 16, 17.5 and 18, just like all gas mixtures. Increase, and then the operating temperature rises, causing the exhaust gas temperature to rise. In Honge biodiesel applications, the exhaust gas temperature is higher than that of diesel. -Particulate matter from biodiesel fuel may not have enough capacity to be completely consumed before TDC[13]; therefore, some fuel combinations are usually consumed in the initial stages of development, leading to post-combustion of the fuel, which in turn leads to post-combustion of the fuel. To increase the smoking temperature. Like biodiesel, it is mixed at full load at different pressure levels. The flue gas temperature continues to rise, which can be attributed to the higher operating temperature at the higher pressure ratio[11].

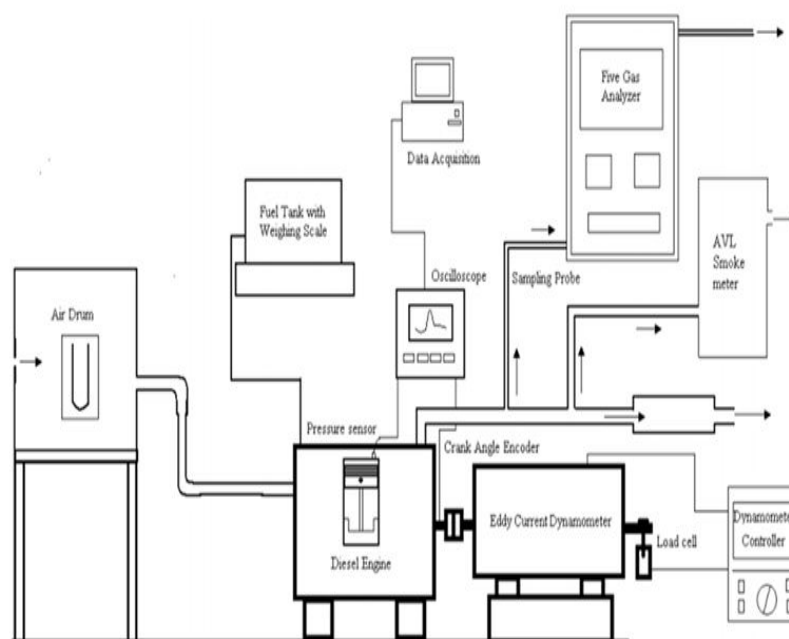


Fig 3. 2-D diagram of the experimental setup without DPF

III. PROPERTIES OF CRUDE PONAGAMIA OIL:

For all three pressure levels 16, 17.5, and 18, as with all gas mixtures, the B20 stack flue gas temperature range increases with increasing diesel load. Operating temperature, which will increase the exhaust gas temperature. The exhaust gas temperature is higher than that of a diesel engine. -Biodiesel pellets may not have enough capacity to be completely consumed before TDC; therefore, some fuel combinations are usually consumed in the early stages of development, leading to post-combustion of the fuel, which in turn leads to post-combustion of the fuel. In order to increase the smoke temperature, Fully mix in biodiesel. Loads at different pressure levels. The exhaust gas temperature continues to rise, which can be explained by the higher operating temperature and higher pressure drop. Table 2 shows the unsaturated fat structure and Table 2 shows Physicochemical Properties of Pongamia pinnata – unrefined petroleum[10].

Fatty acid Composition of pongamia oil (20)	
Fatty acid composition of pongamia oil	Percentage(%)
Palmatic acid (C16)	11.65
Stearic acid(C18)	7.5
Oleic acid(C18.1)	51.59
Linoleic acid(C18:2)	16.64
Eicosanoic acid(C20)	1.32
Dasocasanoic acid(C22)	1.45
Tetracacasanoic acid(C24)	1.09

Table 2

Physical-Chemical properties of Pongamia pinnata crude oil [20]			
Sl. NO.	Property	Unit	Value
1	Colour	-	Yellowish Red
2	Odour	-	Characteristic Odd Odor
3	Density	gm/cc	0.924
4	Viscosity	mm ² /s	40.2
5	Acid value	mg/KOH	5.4
6	Iodine Value	-	87
7	Saponification value	-	184
8	Calorific value	kcal/kg	8742
9	Spacific Gravity	-	0.925
10	Unsaponifiable matter	-	2.9
11	Flash Point	⁰ C	225
12	Fire Point	⁰ C	230
13	Cloud Point	⁰ C	3.5
14	Pour Point	⁰ C	-3
15	Boiling Point	⁰ C	316
16	Cetane Number	-	42
17	Copper Strip Corrosion	-	Not Corrosion Observed
18	Ash Content	In%	0.07

Table 3

3.4 PROCEDURE FOR PRODUCING PONGAMIA BIODIESEL:

There are basically two cycles in the production of water yellow biodiesel: A. Esterification: the formation of biodiesel through esterification is explained as follows: Methyl ester is introduced through artificial reaction with liqueur (methyl) in a legume plant Carranji oil. Two-phase measures are used for the transesterification of Kalanja oil. The most important (corrosion catalysis) stage of the cycle is due to the esterification with methanol (99% purity) and corrosive sulfur pulses, thereby reducing the content of free unsaturated fats (FFA) in Karandzhi oil. Corrosion within one hour at 57°C in a closed reactor (98% purity)[12]. Unrefined kalanzhi oil is first heated to 500°C, 0.5% by weight of sulfur-containing corrosive substances are added to the oil, and then about 13% of methyl liquid (including methyl solution; excess is added to accelerate the reaction). The reaction is continued to stir at 700 rpm, and the temperature is maintained at 55-570°C for 90 minutes. The usual FFA test is performed every 25-30 minutes. The reaction is stopped when the FFA drops to 1%. One of the main disadvantages of catalytically esterified, corrosive FFA is the removal of

water. Water will prevent the FFA to ester reaction from completing. After dehydration, the esterified oil is transferred to the transesterification process [11].

3.5 Transesterification:

In the production of biodiesel by transesterification, sodium hydroxide (NaOH) is usually used with 1% of the total oil. Use a standard mixer to dissolve in 13% purified methanol (CH_3OH) at 700 rpm. Speed up for 20 minutes. Changed the position of the liquid and pulse to maintain synergy and prevent moisture absorption. After adjustment, it is gradually accelerated in the preheated esterified oil. When methanol is added to oil, the structure is closed to avoid dehydration and prevent moisture from entering. The reaction temperature of the mixture is maintained at $60\text{--}650^\circ\text{C}$ (close to the limit of the methyl solution content) to accelerate the reaction. The recommended reaction time is 70 minutes. The speed is maintained at 560-700 rpm. Use excess solution regularly to ensure complete conversion of fats or oils to their esters. The reaction mixture was removed every 20 minutes [12]. For FFA research. After confirming that the methyl ester formation is complete, stop heating, cool the article and put it in the isolation tube. When the answer is complete, it is assumed that 8-10 hours have passed in the selected channel. ...At this stage to absorb two important elements: glycerol and biodiesel; everyone has a lot of answers to the amount of methanol used; the glycerol stage is much denser than the biodiesel stage, and it increases with the increase in biodiesel content stable. Two can be separated from the bottom of the swamp by gravity with fresh glycerin. In the separation of glycerol and biodiesel stage, the excess liquid is removed through the cleaning of each stage. After separating the glycerin and lye from the wastewater, gently rinse the original biodiesel with warm water to remove any residue or detergent. The transesterification process is shown in Figure 1.2 See Table 4 for the observation table of biodiesel production [13].

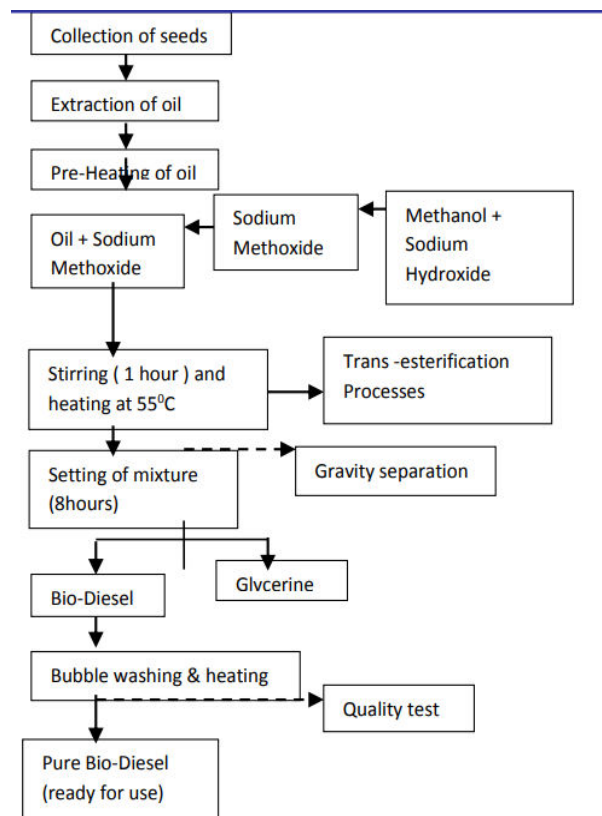


Fig 4. Transesterification process

Observation table (oil taken for reaction=1 Lit Karanja oil)[21]			
Esterification Reaction			
Reaction Time	Reaction Temperature	Chemicals	Quantity
60-80mn	60-65°C	H ₂ SO ₄	0.50%
		Methanol	13%
Trans-esterification Reaction			
After estrification to check fatty acid level (<1% Suitable for trans esterification)			
60-65min	60-65°C	NaOH	1%
		Methanol	12%

Table 4

3.6.Properties of biodiesel of pongamia pinnata:

The combustion characteristics of biodiesel affect engine performance and the expression of output current in a single-chamber engine. These characteristics are very important for biodiesel and diesel in CI engines. Many scientists have studied the impact characteristics of biodiesel and its mixture in diesel engines, such as braking force. Stop the obvious fuel and smoke consumption. [twenty three][13]. The characteristics of biodiesel conform to the principles of biodiesel. Mushroom oil contains more than half of unsaturated fats, which makes them prone to oxidation. The value and consistency of biodiesel has increased, but the iodine value has decreased [14]. The flame and fire source of biodiesel and auto-start temperature are higher than petroleum diesel. It will persist during the ignition of biodiesel. An important characteristic of biodiesel is that it contains approximately 10% oxygen, which is usually not found in diesel fuel. In addition, they are safe, have higher biodegradability and almost contain no sulfur [15]. Biological fillers have several advantages over oil, such as reduction of CO and HC emissions and anti-knock treatment, which allows the use of higher engine pressure ratios based on the observed engine characteristics. Karanja methyl ester, Karanja oil methyl ester has proven to be a suitable alternative fuel due to its excellent performance. Compare the petroleum derivatives shown in Table 4 with these properties. Table 4: Correlation between the characteristics of Pongamia biodiesel and diesel[14].

Property	Pongamia oil methyl ester	Petroleum diesel
Viscosity(cst)(30°C)	52.6	5.51
Specific Gravity (15°C/4°C)	0.917	0.841
Solidifying point (C)	2	0.14
Cetane value	51	47.8
Flash point (C)	110	80
Carbon Residue (%)	0.64	0.05
Distillation (C)	284-295	350
Sulphur (%)	0.13-0.16	1
Acid value	1.0-38.2	-
saponification value	188-198	-
Iodine value	90.8-112.5	-
Refractive Index (30°C)	1.47	-



IV. RESULTS AND DISCUSSIONS

A lot of research has been done on Karandzha oil, and some interesting results have been obtained: The thermal efficiency of brakes based on Karangi oil methyl ester is lower than that of diesel; however, the thermal efficiency of mixtures up to B-20 is very close: between 180 and 200 Under the injection pressure of bar, the discharge volume decreases and the productivity increases. Under 200 bar injection pressure, the full-load HC emissions of B20 and B40 decreased by 12.8% and 3%, respectively, while the BSEC of B20 and B40 were slightly higher. Since the injection pressure of a single-cylinder diesel engine is constant, the volumetric efficiency of the Karanja diesel/methyl ester mixture is constant at different pressures. It has been shown that over the entire load range, compared with diesel, BSFC increases as the mixing ratio increases[15]. Under full load, the NO_x of B20 and B40 were reduced by 39% and 28%, respectively. When the load changes and other parameters remain unchanged, the thermal efficiency BSFC, mechanical efficiency and volumetric efficiency are equivalent to those of a diesel engine. Using Karanja biodiesel, CO, HC and even NO_x emissions are lower. When using vegetable oil as a fuel for diesel engines, the increase in viscosity is a serious problem. In this study, the viscosity was reduced from 40.2 to 5.51 mm² through esterification and transesterification. Biodiesel can also be used alone (B-100), but the engine may need to be modified to avoid maintenance and performance issues. Biodiesel is usually mixed with diesel fuel in a certain proportion to function effectively without modification[14].

- a) Brake thermal efficiencies of Pongamia oil methyl ester blends are very close to diesel and 20% blend with diesel, B20 provided the maximum efficiency for biodiesel operation for all compression ratios.
- b) An improvement in BTE was observed for higher compression ratios.
- c) Brake specific energy consumption for biodiesel blends is more than that of diesel and decreases for higher compression ratios.
- d) Exhaust emissions Smoke, CO, HC were reduced for WCO biodiesel blends when compared with diesel values for all compression ratios and higher compression ratios have the advantage further reduction in those emissions.
- e) Increase in NO_x emission was observed for biodiesel blends compared to that of diesel for all compression ratios.
- f) ANN approach applied to predict the performance and emission characteristics. Satisfactory results were observed with the regression coefficients lying closer to 1 and the Mean relative error is within 1-9% for the entire test data which is considered to be within the acceptable limits.
- g) Hence ANN approach can be used for the prediction of engine performance and emission characteristics of I.C engines by performing a limited number of tests instead of detailed experimental study thus saving both engineering effort and funds.

V. CONCLUSION

Several researchers used different evaluation techniques, and the results were different from Diesel. Several preliminary tests with water yellow methyl ester (PME) are caused by different mixing pressures, increased pressure ratios, added substances, loadings, etc.; good and excellent performance has been achieved. A mixture of 200 bar compression elements and 16:1 compression ratio can be used as ideal performance, and the internal combustion engine can be fueled with Karanja biodiesel without compromising energy efficiency, thus contributing to extensive containment of air pollution. India's interest in transportation fuels is steadily growing. The cost of petroleum products has risen steadily and the general market inventory level is uncertain. In order to limit crude oil imports, it is important to choose biofuels that are easy to manage and environmentally friendly. Pongamia biodiesel is meaningful to ensure and not pollute the environment. Ensure that rural areas in India meet conventional energy and fertilizer needs. Explicitly explore a mechanical oil drive that is completed in Pongamia to standardize agricultural development, with little effort and convincing, to find groups with financial problems, high yields and high oil grades that meet the unique agricultural conditions in India

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