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Trial Investigation of Diesel Engine Using Different Blends of Blended Pongamia-Coconut Biodiesel as Alternative Fuel

Shaik Rafi
Assistant Professor, Dept. of Mechanical Engineering, Nalanda Institute of Engg. and Tech., Kantepudi, India

***Abstract*: Diesel motors are the most productive prime movers for transportation, farming hardware and enterprises. The quick consumption of oil holds and rising oil costs has prompted the look for elective powers. Biodiesel is an elective diesel fuel gotten from vegetable oils and creature fats holds great guarantees as an eco-accommodating option in contrast to diesel fuel. Transesterification process is the most broadly utilized innovation for delivering biodiesel from vegetable oil. In the present examination, blended pongamia-coconut methyl ester is created through transesterification process by considering pongamia and coconut oil in equivalent extents utilizing NaOH impetus under lab set up. The acquired biodiesel is mixed with oil diesel for different proportions (10%, 20%, 30%, 40% and half) to assess its fuel properties. Exploratory examinations were led on unmodified single chamber diesel motor utilizing distinctive mixes of blended biodiesel at variable loads and settled infusion weight. The outcome demonstrates that fuel properties and motor execution are better up to biodiesel mix B20.**

***Keywords*: Transesterification, Pongamia oil, Coconut oil, Engine Performance, sodium hydroxide.**

1. Introduction

Powers got from sustainable organic assets for use in diesel motors are known as biodiesel. Biodiesel is environmentally friendly liquid fuel similar to petrol-dieselin combustion properties. Increasing environmental concern, diminishing oil stores and farming based economy of our country are the driving forces to promote biodiesel as an alternate fuel. Since India is net shipper of vegetable oils, eatable oils can't be utilized for generation of biodiesel. India can possibly be a main world maker of biodiesel, as biodiesel can be reaped and sourced from non- eatable oils like Jatropha Curcas, Pongamia Pinnata, Neem (Azadirachta indica), Mahua, castor, linseed, Kusum (Schlechera trijuga), and so on [1].

The principal utilization of vegetable oil in a pressure start motor was first exhibited by Rudolph diesel utilizing nut oil in his diesel motor [2]. Later with the accessibility of modest oil, unrefined petroleum parts were refined to fill in as „diesel‟, a fuel for CI motors. Amid the time of World War-II, vegetable oils were again utilized as fuel in crisis circumstances when fuel accessibility turned out to be rare. These days, because of constrained assets of non-renewable energy sources, rising raw petroleum costs and the expanding worries for condition, there has been reestablished center around vegetable oils and creature fats as an option in contrast to oil energizes [3].The utilization of oils from coconut, soybean, sunflower, safflower, shelled nut, linseed, rapeseed and palm oil among others have been endeavored. The long haul utilization of vegetable oils prompted injector coking and the thickening of crankcase oil which brought about cylinder ring staying. Thusly, vegetable oils are not utilized in SI motors as a result of perseverance issues [4].

Scientists have demonstrated that when the vegetable oil is changed over to esters of alcohols by transesterification, it turns into a potential substitute to diesel and the term biodiesel is utilized to speak to such energizes. Biodiesel can be utilized in its perfect frame or as a mix with traditional diesel fuel in diesel motors and the utilization of biodiesel in diesel motors requires no equipment adjustment. Likewise, biodiesel is a prevalent fuel than diesel on account of lower sulfur content, higher blaze point and lower fragrant substance [5].

Impressive endeavors have been made to create vegetable oil subsidiaries that surmised the properties and execution of hydrocarbons-based diesel energizes. The issue with substituting triglycerides for diesel fuel is for the most part connected with high consistency, low unpredictability and polyunsaturated characters. These can be changed in no less than four different ways: pyrolysis, miniaturized scale emulsion, weakening and transesterification [6].

2. Approach

A. Transesterification process

The transesterification procedure is the response of a triglyceride (fat or oil) with a liquor to shape esters and glycerol. A triglyceride has a glycerine atom as its base with three long chain unsaturated fats connected. A mid the transesterification procedure, the triglyceride is responded with liquor within the sight of an acidic or fundamental impetus. The liquor responds with the unsaturated fats to shape the mono-alkyl ester, or biodiesel and rough glycerol. When all is said in done, methanol or ethanol is the liquor utilized (methanol produces methyl esters, ethanol produces ethyl esters). The response between the fat or oil and the liquor is a reversible response and thus liquor must be included overabundance to drive the response towards the privilege and guarantee finish transformation. The results of the response are simply the biodiesel and glycerol. The trial philosophy of creating biodiesel is appeared in Fig. 1.

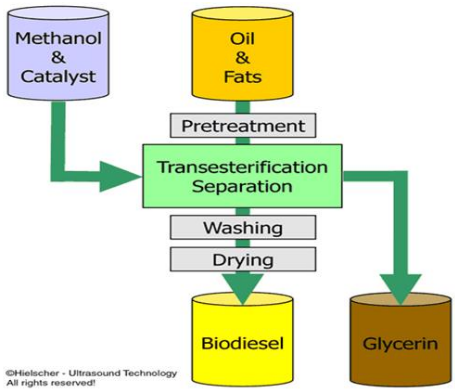

Fig. 1. Biodiesel production process

B. *Experimental set up*

The analyses were led on a kirloskar made four stroke single barrel water cooled coordinate infuse pressure start motor with no equipment adjustments. Blended pongamia– Coconut biodiesel mixes (B10, B20, B30, B40, and B50) and diesel was utilized to test an ordinary motor. The motor was begun by manual hand wrenching and test is directed for different burdens with steady motor speed of 1500 RPM. Execution parameters like brake control, brake particular fuel utilization and brake warm effectiveness were assessed. The motor particulars are given in the Table 1.

Table 1
Engine specifications

Type	Kirloskar
Details	Single cylinder, four stroke, water cooled
Bore & Stroke	80×110 mm
Rated Power	3.75 KW at 1500 RPM
Compression Ratio	16:1to 25:1
Starting	Hand start with cranking handle

3. Results and discussion

The Table 2 demonstrates the fuel properties of Diesel, Mixed biodiesel and its mixes. Biodiesel mixes of Mixed Pongamia-Coconut methyl esters with diesel on 10, 20, 30, 40, and half volume premise was arranged and fuel properties are estimated following standard technique. The properties of blended biodiesel and its mixes are contrasted and ASTM biodiesel benchmarks as appeared in Table 2.

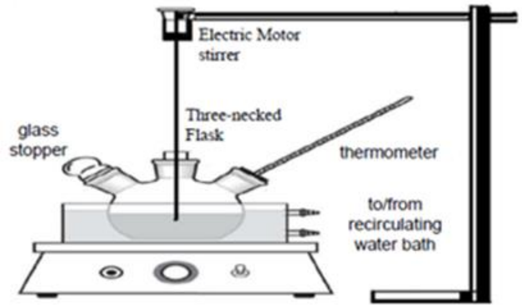

Fig. 2. Transesterification reaction experimental setup

Fig. 3. Mixed Pongamia-Coconut biodiesel blends

A. *Specific fuel utilization*

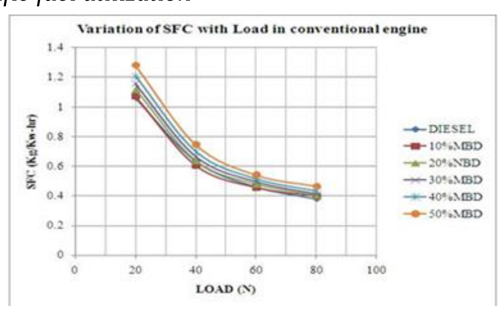

Fig. 4. Variation of specific fuel consumption with load

Particular fuel utilization is a proportion of the eco-friendliness of a motor. It is the rate of fuel utilization isolated by the power created. Fig. 4 demonstrates the variety of particular fuel utilization with load for Mixed Pongamia and

Table 2
Fuel properties of Diesel, Mixed biodiesel and its blends

Properties	Diesel	Biodiesel Blends					B100
		B10	B20	B30	B40	B50	
Viscosity (Cst)	3.02	3.201	3.319	3.409	3.84	4.02	4.76
Density (Kg/m^3)	816	820	826.7	839.5	850.8	856.2	876.4
Flash point (°C)	52	57	60	64	70	78	121
Fire point (°C)	61	62	65	69	76	85	128
Calorific value (KJ/Kg)	43796	42936	42701	42100	41650	41317	39251

Coconut biodiesel mixes for a traditional motor. From Fig. 4 it is seen that blended biodiesel mixes B10 and B20 have particular fuel utilization near diesel. It is additionally seen that the particular fuel utilization of all the biodiesel mixes is higher than diesel at all the heaps. A higher extent of blended oil in the mixes builds the thickness which thusly expanded particular fuel utilization because of poor atomization of the fuel.

B. Brake warm effectiveness

Fig.5 demonstrates the variety of Brake Thermal Efficiency with load for Mixed Pongamia and Coconut biodiesel mixes for a customary motor. Brake Thermal Efficiency is characterized as brake intensity of motor as a component of the warm contribution from the fuel. From the Fig. 5 it is likewise seen that mixes B20 and B30 have the effectiveness nearly closer to diesel. The greatest effectiveness acquired for blended biodiesel mix is 21.18% which is near the effectiveness of diesel. Mix B50 demonstrates the base proficiency at all the heaps. The reduction in brake warm effectiveness for higher mixes might be because of the lower warming quality and higher thickness of mixes with a higher extent of biodiesel.

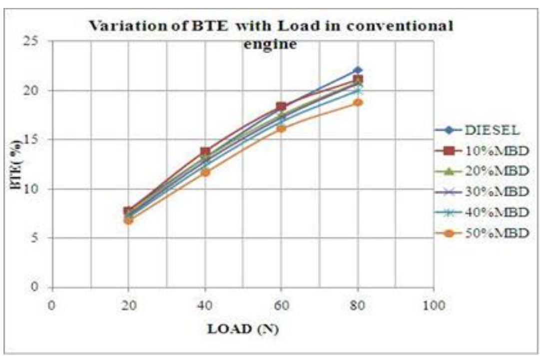

Fig. 5. Variation of brake thermal efficiency with load

4. Conclusion

A solitary advance process i.e., Transesterification is completed for the blended pongamia and coconut oil which contained low level of FFA to get the biodiesel. It was seen that the acquired biodiesel has high thickness and consistency which made it impractical to use in its unadulterated shape however it very well may be mixed with diesel to get properties relatively like that of diesel. The mixes were set up with biodiesel rates of 10, 20, 30, 40 and 50 and the accompanying ends were drawn from this examination.

- Mixed Pongamia and coconut biodiesel fulfills the imperative fuel properties according to ASTM particular of biodiesel.
- It is seen that for the biodiesel mixes of 10% and 20% the thickness, fire point, streak point and calorific esteem were near that of diesel, which makes them appropriate for utilizing them as an option for diesel.
- The blended pongamia and coconut demonstrates higher biodiesel yield of 72.5%.
- The blended biodiesel mix B10 demonstrates the higher brake warm proficiency which is marginally not as much as that of diesel.
- The particular fuel utilization of blended biodiesel mixes B10 and B20 indicates esteem closer to diesel.

Blended pongamia and coconut biodiesel mixes B10 and B20 can be utilized as elective fuel in diesel motor.

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