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Biodiesel Production from *Jatropha curcas* and *Pongamia pinnata* oils and Study of Kinematic Properties

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ABSTRACT
The present study was carried out considering the availability of Pongamia pinnata (Karanja) and, Jatropha curcas (Erandi) oil in the local area for biodiesel production. The biodiesel was produced from Jatropha curcas and Pongamia pinnata oils by using transesterification process. The fuel properties of biodiesel such as kinematic viscosity and specific gravity were found within the limits of BIS standards. The operational efficiency of the diesel pump set for various blends of biodiesel was found near to the expected efficiency of 20%. The produced biodiesel can be used as an alternative and non-conventional fuel to run all types of compression ignition engines.
Key Words: *Biodiesel, Jatropha oil, Pongamia oil, transesterification*

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INTRODUCTION

The opportunity of biodiesel from Jatropha plant for replacing fossil diesel is promising because Jatropha can be cultivated in the various geographical areas. In Indonesia more than 40% of fossil diesel is used for vehicles or transportations and 74% for industries and electric power plants [1].During the last few centuries, man has exploited the buried resources of the earth like coal, gas, and oil to improve the quality of human life. The reserves of these fuels are however limited as they take thousands of millions of years to form and are fast depleting hence alternatives are required to fulfill the needs.Biodiesel is made through a chemical process called transesterification; this process involves altering the chemical properties of a vegetable oil by using methanol [2]. *Jatropha curcas* seeds contain 27-40% oil that can be processed to produce a high-quality biodiesel fuel that is usable in a standard diesel engine, especially if the oil of the seeds is well extracted [3]. *Pongamia pinnata* trees are normally planted along highways, roads, and canals to stop soil erosion and its seeds contain 30-40% oil. Its oil if converted into biodiesel can be one of the best substitutes for conventional fuels. *Jatropha curcas* is a drought-resistant perennial plant, growing in marginal/poor soil. The kernels consist of oil to about 60 percent; this can be transformed into biodiesel fuel through esterification. It burns with a clear smoke-free flame, tested successfully as fuel for a simple diesel engine. Biodiesel can extend the life of diesel engines because it is more lubricating and power output will be relatively unaffected by biodiesel. The crude glycerine is also obtained in the biodiesel production process [4,5].

MATERIAL AND METHODS [3,6,7,8]

1) **Collection of oil samples**: The crude oil samples of Jatropha and Pongamia seeds were collected locally from Karad market, Maharashtra (India).
2) **Process of biodiesel production**: The steps followed for production of biodiesel are shown in **Fig-**1 and **Table-1.**
   Pre-treatment: A base-catalyzed transesterification process was selected for biodiesel production. The oil was pretreated with the addition of sodium methoxide which was formed by adding methanol with sodium hydroxide.

Transesterification: The mixture was continuously heated at 550c for 1 h with continuous stirring.
Settling: The method of gravity separation was used for the extraction of biodiesel and further the glycerine (Photoplate-1)
Settling Time: It was allowed to settle down for at least 8 h in the setting flask. During the process of settling, glycerine was settled down and biodiesel floated up.
Washing: It was done by bubble washing process.

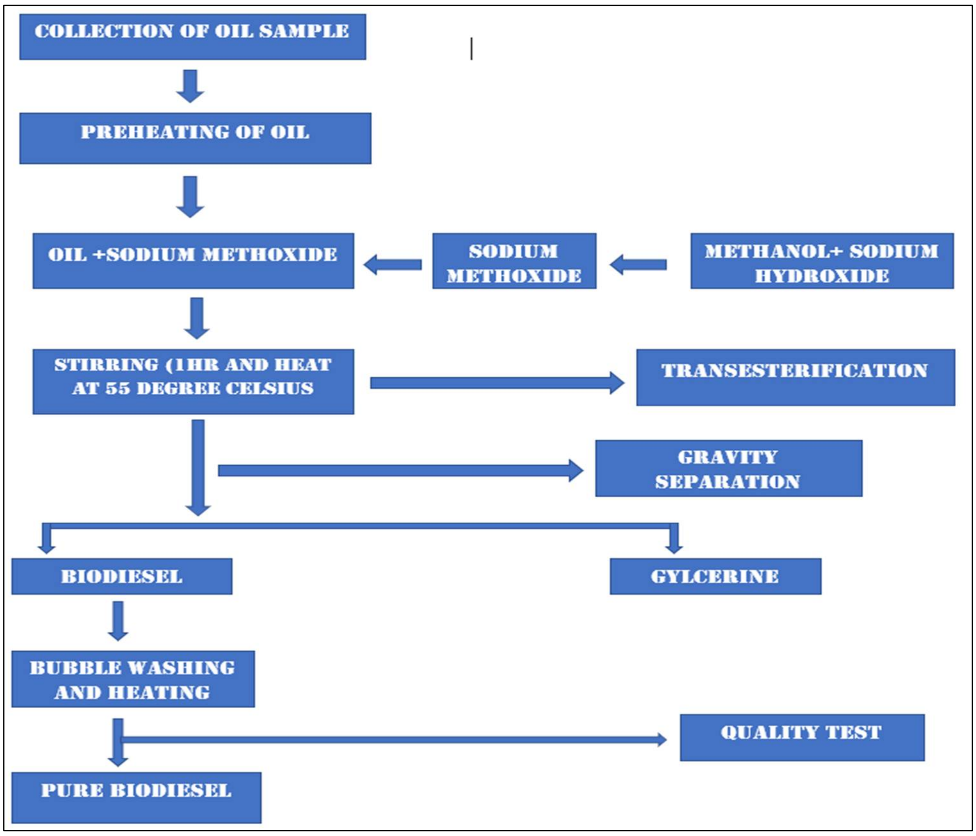
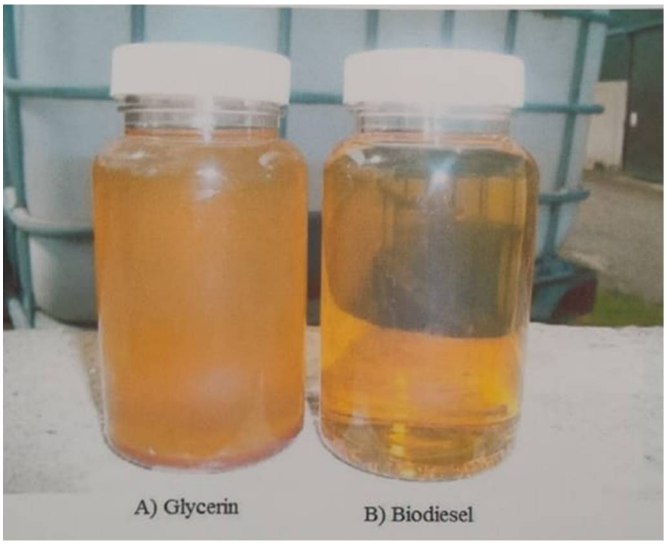


Fig. 1: Flow chart for Biodiesel production



Photoplate-1: Glycerine and Biodiesel

Table1: Biodiesel Recovery in the Transesterification Process

Sr. No.	Oil sample	Amount of Oil used (mL)	Amount of Methanol used (mL)	Amount of NaOH used(mg)	Amount of Biodiesel generated (mL)	Amount of Glycerine generated (mL)
1	For Jatropha	100	20	0.35	75	12
2	For Karanja	100	20	0.35	80	10

Table 2: Chemical Properties of Karanja and Jatropha Raw Oil

Sr. No.	Properties	Karanja Oil	Jatropha Oil
1	Acid value (mg/KOH)	1.52	3.5
2	Saponification value	185	195
3	Iodine value	89	101.7
4	Viscosity(mm^2/sec)	41.06	40.4
5	Viscosity after TES	5.7	5.85
6	Specific gravity	0.909	0.9136

Table 3: Comparative Studies of Properties of Biodiesel with Commercially Available Petroleum Diesel

Properties	*Jatropha* biodiesel	*Karanja* biodiesel	Petroleum or Diesel
Density (g/cm)	0.88	0.905	0.85
Kinematic Viscosity (cst)	4.84	4.08	2-8
Calorific value (MJ/Kg)	41	36.12	45
Input cost %	30	30	67.96
Output cost %	54	46	96 approx.
Sulfur (%)	0	0	<0.5
Carbon residue (%)	0.024	0.016	<0.35

RESULTS AND DISCUSSION

Usage of biodiesel will reduce import dependency and a lot of money would be saved. There would be lesser emission of carbon dioxide and other polluting gases. It would reduce the crop burning and conversion of agricultural residues/wastes to biofuels therefore there will be a further reduction in greenhouse gas emissions.

The amount of glycerine and esterified *Karanja* and *Jatropha* oil obtained by this process are given in Table 1 and photoplate-1.It is found that from 100mL oils used(Jatropha and Karanja each) 75-80ml biodiesel and 10-12mL glycerine was generated

The Kinematic viscosity and other chemical properties are shown in Tables 2 and 3.The kinematic viscosity of *Karanja* oil changed from 41.06 mm/secto 5.7 mm/sec after transesterification process. Similarly, the kinematic viscosity of *Jatropha* oil 40.4 mm/sec changed to 5.85 mm/sec which was nearer to the viscosity of petroleum diesel.

It is evident from Table-2 that the chemical properties raw oils from Jatropha and Karanja showed properties like Acid values 1.52 and 3.5, saponification values of 185 and 195, Iodine values of 89 and 101.7, Viscosity of 41.06 and 40,4, Viscosity after TES 5.7 and 5.85, Specific gravity of 0,909 and 0,9136, respectively.

When we compare the Biodiels generated from oils of Jatropha and Karanja with that to petroleum-based diesel, it is evident that the parameters like density, kinematic viscosity and Calorific value of Jatropha and Karanja biodiesel almost matching to that of petroleum-based diesel.

The Jatropha and Karanja biodiesel has superiority over petroleum-based diesel where in the Jatropha and Karanja biodiesel no sulfur residues were found, carbon residues were 15-20% lesser than petroleum-based diesel and cost wise it is almost 50 % cheaper to petroleum-based diesel(Table-3).

From the above discussion, it is clear that the above biodiesel process will be capable of preparing the oil esters sufficient in quantity for running the commonly used farm engines.

The natural oils as well as used but waste oils(remaining waste oils after frying in cafeteria, hotels and all similar food places)must be subjected to as raw material for production of biodiesel and useful byproduct like glycerine.

REFERENCES

1. Zainudin A, Winaya A, Rahmadesi Y. (2020). Biodiesel generated from Jatropha (*Jatropha curcas* Linn.) seeds selected based on various genotypes crossbred. Energy Reports. 1;6:345-50.
2. Silveira and D. Foster, (2008). "Availability of Biomass Across the Globe," http://www.forest encyclopedia.net/.
3. Achten, W.M.J., Mathys, E., Verchot, L., Singz, V.P., Aert, R. and Muys, B. Jatropha bio-diesel production and use, Biomass and Bioenergy, 2008, 32(12): 1063-1084.
4. Joshi H.C.(2D03) An alternative fuel for future, invention intelligence, NRDC. Vol. 38:5, 2003PP 205-216.
5. Ambedkar Durga(2003) Biodiesel replacement for fuel, Godava, PP27-36.
6. Kelkar Bhalchandra, (2003). Karanja oil- Biodiesel. Godava, 35-45
7. Patil Vinayak &singhKanwarjit, (1991), oil gloom to oil bloom *Jatropha curcus*, Agroforestry federation Maharashtra.33-34.

8. Kotole Ravindra, (2004), Jatropha: Biodiesel plant, Godava Krishi Prakashan, Pune-43,59-61.

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