Jatropha Oil Methyl Ester By Transesterification

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***Abstract*— Considering the increasing population of vehicles on roads it has become extremely important to search for alternative fuel. Biodiesel forms one of the alternative to the traditional fossil fuels. Biodiesel from Jatropha oil forms a great alternative for fuel for developing countries like India whose economy mainly depends on agricultural sector. Cultivation of Jatropha crops helps in giving a financial boost to the countries economy since the crop is resistant to drought and pests. Jatropha is the best plant for future biodiesel production. The oil from Jatropha is mainly converted into biodiesel for use in diesel engines. Jatropha can contribute a reduction of upto 25% of carbon dioxide per hectare per year from the atmosphere.**

***Keywords*— Jatropha, Biodiesel, Yield, Transesterification, Properties.**

I. INTRODUCTION

Biodiesel has similar combustion properties as regular diesel. Biodiesel is defined as the fuel composed of long chain fatty acids derived from vegetable oil or mineral oil. Preparation of biodiesel from Jatropha oil by transesterification process represents one of the most promising option for the use of conventional fossil fuels.

Main constituents in Jatropha are :

Fig. 1 Jatropha Seeds

TABLE I
JATROPHA PROPERTIES

Constituent	%
Moisture	6.20%
Protein	18.00%
Fat	38.00%
Carbohydrates	17.00%
Fiber	15.50%
Ash	5.30%

II. METHOD

Biodiesel from Jatropha oil is mainly obtained from by the transesterification method. Two steps are used in the production of the biodiesel which are given below :

Reduction of the fatty acid contained in the Jatropha oil : As obtained in the test carried out on the jatropha oil, it was discovered that the free fatty acid (FFA) contents of oil are high (21.6%). Hence, it became necessary to reduce it.

Procedure. Crude jatropha oil was poured into a conical flask and heated to a temperature of 60°C. A mixture of concentrated H2SO4 (1% w/w) with methanol (30% v/v) was heated separately at (50°C) and then added to the heated oil in the flask. The mixture was stirred for 1 hour and allowed to settle for 2 hours.

(i) Transesterification : The step by step approach used in the production of the biodiesel is given below :

– 10.5 mL of jatropha oil was measured and poured into 250 mL conical flask and heated to a temperature of 50°C.

– A quantity of methanol was poured in a round bottom flask and soxhlet apparatus, and the heater was turned on. This was done to purify the methanol.

– The sodium hydroxide pellet was placed in the weighing balance to get exactly 0.25 g.

– A solution of potassium methoxide was prepared in a 250 mL beaker using 0.25 g (i.e., catalyst concentration of 0.5%) of sodium hydroxide pellet and 63 mL (i.e., mole ratio of oil to methanol of 1 : 6) of methanol. The solution was properly stirred until potassium hydroxide pellet was completely dissolved.

– The potassium methoxide solution was placed in the oven to bring its temperature to 60°C.

– The potassium methoxide solution was then poured into the warm jatropha oil and stirred vigorously for 50 minutes using a magnetic stirrer. The mixture was then allowed to settle for 24 hours in a separating funnel.

– The biodiesel was then poured into a separate beaker, while the lower layer (which comprises of glycerol and soap) was collected from the bottom of the separating funnel.

– Warm water was then used to wash the biodiesel to remove any excess glycerol and soap that remain in the funnel. This was done until the clear water was seen below the biodiesel in the separating funnel.

–The washed sample was dried by placing it on a hot plate and excess water still in the biodiesel was removed.

–The quantity of biodiesel collected was measured and recorded.

–The above procedures were repeated by varying the mole ratio of jatropha and methanol, while keeping catalyst concentration, stirring time, and temperature constant.

III. RESULTS

The effect of the quantity of catalyst NaOH used in the production of biodiesel has the following effect on the yield of biodiesel as shown in the graph.

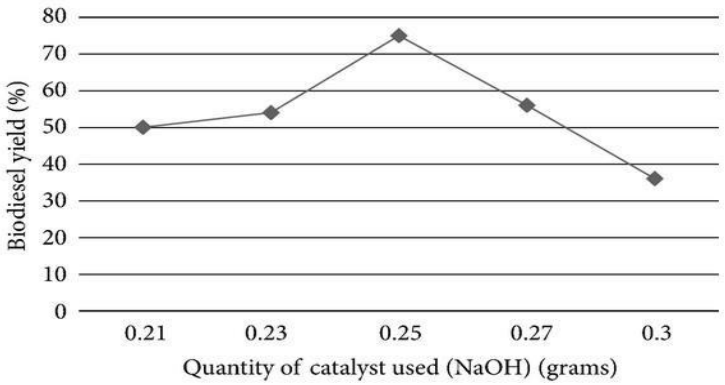

Fig. 2 % Jatropha Biodiesel Yield

TABLE III
PHYSIO-CHEMICAL PROPERTIES JATROPHA BIODIESEL

Property	Unit	Limit (ASTMD6751)	Result
Specific gravity	kg/L	0.95 max	0.90
Kinematic viscosity	c.s.t	1.9–6.0	4.93
Cloud point	°F	40 max	37
Flash point	°F	130 min	138
Cetane number	—	40 min	52
Water by distillation	% vol	0.5 max	Trace
Free glycerine	% mass	0.02 max	0.05
Total glycerine	% mass	0.24 min	0.32

IV. CONCLUSIONS

In the current investigation, it has confirmed that jatropha oil may be used as resource to obtain biodiesel. The experimental result shows that alkaline-catalyzed transesterification is a promising area of research for the production of biodiesel in large scale. Materials for use in the production of biodiesel are readily available without the need for special equipment or scarce chemicals. Used oil from restaurant can be used. Oil from trees can also be used in the production of biodiesel. On small scale production, the cost of production is low, but if mass production and accuracy is the goal, the cost is high. Glycerin which is the by-product of the chemical reaction can be sold to the pharmaceutical companies, since it is used to produce valuables such as creams and toothpaste. Effects of different parameters such as temperature, time, reactant ratio, and catalyst concentration on the biodiesel yield were analyzed. The best combination of the parameters was found as 8 : 1 molar ratio of methanol to oil, 1.0% KOH catalyst, 60°C reaction temperature and 60 minutes of reaction time. This optimum condition yielded 90% of biodiesel. From the characterization of the biodiesel, the physical properties of biodiesel from jatropha oil with methanol were found to be within the ASTM specified limits. The viscosity of jatropha oil reduces substantially after transesterification and is comparable to diesel. Biodiesel characteristics like density and viscosity are comparable to that of the petrol diesel.

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