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# Production of Jatropha Methyl Ester

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***Abstract*: In a past span of years there is a huge development in the automobile field it creates a demand for petroleum products leads to insufficient supply of fuels and also it causes more pollution. Due to this all the developed and developing countries are focusing in producing biodegradable fuels to reduce the cost and demand of fossil fuels and mineral oils. Many researchers are identify that vegetable oils and biogas are the beat alternate to the mineral oils. Since the vegetable oils are eco-friendly and biodegradable so it plays the major role in production of alternate fuels. In this paper the production of jatropha ester and the tribological properties were studied. Transesterification process was carried out to produce the ester from jatropha curcas oil. Jatropha curcas oil is a non-edible oil, ester prepared from jatropha curcas oil was added with nano copper oxide particles to improve the wear resisting property and reduce the pollution.***

***Keywords* : Jatropha Oil, Transesterification, Lubricant, Nanoparticle.**

## I. INTRODUCTION

Current scenario point out that, for a long period of time the present conventional fuels are not sufficient to meet the requirement of fuels and lubricants for automobiles. It creates the awareness among the researchers to focusing on production alternate fuels. Sunflower oil, cater oil, orange oil, jatropha curcas oil are commonly used to vegetable oils to produce the biodegradable oils. Bio lubricant is prepared by chemical reaction of jatropha oil with methanol. The process is known as transesterification process. It requires a strong catalyst usually potassium or sodium hydroxide. It produces the new mythyl ester from jatropha curcas oil. Compare to fossil fuel, biofuel contribute lesser global warming. Internal combustion engines operated by bio fuel consist of lesser emission compare to the fossil fuels. Traditional research focus only on vegetable oils to produces the bio fuel after hat the trend was changed to focusing on synthetic ester to produce the bio fuels.

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The best way to produce methyl ester from jatropha vegetable oil is transesterification process. Jatropha curcas is a prime source of non-edible oil in India. Presence of catalyst initiate the transesterification process. Jatropha seeds consists of unsaturated fatty acid around 30% remaining saturated. After the completion of transesterification process the ester and Glycerine will be formed in the separating funnel. Glycerine are used in cosmetic industries for preparation of candles, soaps etc., energy sectors plays the major role in the development of country, but high rate of consumption leads to exhaustion of conventional fuels, it urge the countries to move towards the biofuels. Ester yield was affected by varies parameters like reaction temperature, reaction time, type of catalyst and so on. Potassium hydroxide increase the yield during the transesterification process compare to the sodium hydroxide.

### *1.1. Jatropha curcas*

There are different types of vegetable oil are available in the world but jatropha curcas is one of the best oil to produce the methyl ester because it was non edible and prime source of India. If jatropha oil is directly used in IC engines its create the technical problems to avoid these transesterification process was carried out. Cost of preparation of bio fuel from jatropha curcas oil is slightly higher than production of conventional fuel.

## II. PRODUCTION PROCESS

### A. Transesterification

Presence of catalyst the chemical reaction of jatropha oil with alcohol is known as transesterification process. Potassium hydroxide and hydrochloric acid are used as catalyst and alcohol during the transesterification process. At end of transesterification process the mixture was kept in a separating funnel for 24 hours. After the duration the mythyl ester and glycerine was settled in the separating funnel. Bottom of funnel contain the by product (glycerine) and the top portion contain mythyl ester.

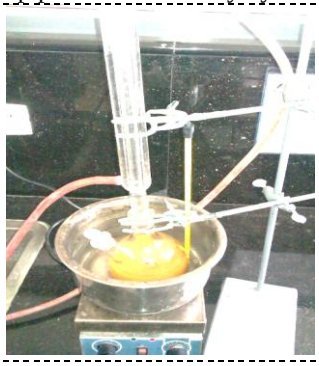

**Figure 1.** Experimental setup

**Figure 2.** Neutralization

### B. Separation

Preparation process is nothing but the purification of ester from glycerine after the completion of transesterification process.

### C. Investigational Procedure

#### *2.1 Neutralization*

In general vegetable oils contain nearly 20% of free fatty acid it must be removed in vegetable oil to prepare the methyl eater. To neutralise the jatropha oil, hydrochloric acid and catalyst was added and stirred for 30 minutes in a room temperature.

RCOOH + NaOH _ RCOONa + H2O

#### 2.2 Ester Production

This work focusing on preparation of jatropha curcas methyl ester by transesterification process. Moisture content in jatropha oil was removed by stirring of oil at 650C continuously for 10 minutes in a round bottom flask. Based on weight percentage the proportion of jatropha oil, catalyst and alcohol will be selected. L27 orthogonal array is formulated based on process parameters like weight percentage of methanol, catalyst and stir speed to prepare the methyl ester from jatropha oil. Three level and three parameter were selected and the L27 orthogonal array was framed. Initially moisture content and free fatty acid will be removed then the jatropha oil and methoxide will be heated and stirred continuously for 60 minutes in a round bottom flask. After transesterification process the mixture was kept in separating funnel for 1 day to settle down the glycerol and methyl ester. In a round bottom flask the lower layer contain the glycerol, unreacted catalyst and upper layer contain the methyl ester. After the settling time the glycerol will be removed from separating funnel and water wash will be carried to obtain a pure methyl ester. Pure jatropha methyl ester was collected and the characterization of oil was carried out.

**Figure 3. Separation process**

### D. Ester Characterization

As per the ASTM standard the following test were conducted and tribological properties of jatropha methyl ester was studied. Redwood viscometer is used to determine the viscosity of oil, flash and fire point will be determine by using Cleveland open cup apparatus.

**Table 1.** Experimental result.

| Combination No | Combination | | | Ester Yield | | | |
|---|---|---|---|---|---|---|---|
| | Methanol (ml ) | KOH (Grams) | Speed (rpm) | In Wt. (Grams) | In Wt. (%) | In (ml ) | In ml (% ) |
| 1 | 100 | 0.871 | 800 | 204.3 | 93.82 | 93.7 | 1 |
| 2 | 110 | 1.306 | 800 | 167.69 | 77.01 | 76.1 | 2 |
| 3 | 100 | 1.088 | 900 | 138.92 | 63.80 | 64.5 | 3 |
| 4 | 100 | 1.306 | 1000 | 119.59 | 54.92 | 56.1 | 4 |
| 5 | 110 | 0.871 | 900 | 216.88 | 99.60 | 98.4 | 5 |
| 6 | 110 | 1.088 | 1000 | 211.76 | 97.25 | 96.9 | 6 |
| 7 | 120 | 0.871 | 1000 | 208.85 | 95.91 | 95.3 | 7 |
| 8 | 120 | 1.088 | 800 | 199.11 | 91.44 | 86.9 | 8 |
| 9 | 120 | 1.306 | 900 | 211.15 | 96.97 | 96.1 | 9 |
| 10 | 100 | 1.088 | 800 | 154.32 | 70.87 | 70.9 | 10 |
| 11 | 100 | 1.088 | 900 | 166.77 | 76.59 | 75.7 | 11 |
| 12 | 100 | 1.088 | 1000 | 163.3 | 74.99 | 73.7 | 12 |
| 13 | 110 | 0.871 | 800 | 135.99 | 62.45 | 62.5 | 13 |
| 14 | 110 | 0.871 | 1000 | 167.99 | 77.15 | 76.5 | 14 |
| 15 | 110 | 1.088 | 800 | 188.02 | 86.35 | 86.5 | 15 |
| 16 | 110 | 1.088 | 900 | 180.39 | 82.84 | 82.1 | 16 |
| 17 | 110 | 1.306 | 900 | 176.26 | 80.95 | 76.9 | 17 |
| 18 | 110 | 1.306 | 1000 | 173.44 | 79.65 | 72.1 | 18 |
| 19 | 100 | 1.306 | 800 | 166 | 76.23 | 74.1 | 19 |
| 20 | 100 | 1.306 | 900 | 173.42 | 79.64 | 79.3 | 20 |
| 21 | 100 | 1.306 | 1000 | 179.56 | 82.46 | 82.9 | 21 |
| 22 | 120 | 0.871 | 800 | 181.48 | 83.34 | 85.3 | 22 |
| 23 | 120 | 0.871 | 900 | 185.24 | 85.07 | 87.3 | 23 |
| 24 | 120 | 1.088 | 900 | 182.55 | 83.83 | 85.7 | 24 |
| 25 | 120 | 1.088 | 1000 | 196.16 | 90.08 | 92.5 | 25 |
| 26 | 120 | 1.306 | 800 | 188.82 | 86.71 | 86.5 | 26 |
| 27 | 120 | 1.306 | 1000 | 162.23 | 74.50 | 74.9 | 27 |

**Table 2. Properties of Jatropha methyl ester**

| PARAMETERS | RESULTS |
|---|---|
| Kinematic Viscosity at 40ºC | 22.54 CST |
| Kinematic Viscosity at 100ºC | 8.18 CST |
| Viscosity index | 184.23% |
| Flash point | 197ºC |
| Fire point | 217ºC |
| Water Content | 0.26% |
| Iodine Value | 92% |
| Acid Value | 32.39 mg of KOH/gm% |

## III CONCLUSION

The experimental results were indicating that jatropha curcas oil will be one of suitable vegetable oil to produce the biofuel. Investigation results conforms that the jatropha methyl ester was the best alternate to mineral fuels. Results obtained by considering the varies process parameters and different level indicate that the sample five was produce the maximum yield.

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