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# COMPARATIVE ANALYSIS OF COMBUSTION SPRAY COCONUT OIL AND JATROPHA OIL

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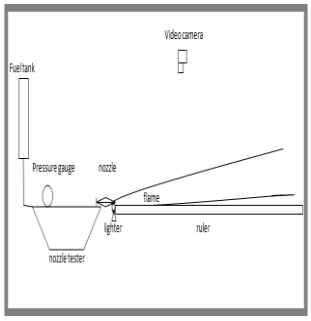
## Graphical abstract




## Abstract

The negative influence of fossil fuels and the limited supply of fossil fuels to encourage researchers are looking for alternative fuels to renewable energy, namely coconut oil and jatropha oil. The purpose of this study was to determine the ratio of the combustion flame spray on burning long, wide combustion and combustion stage by studying the experimental results of burning coconut oil and jatropha oil, camera recording video at 420 fps in the spray nozzle tester with 1900 psi pressure. The results of the comparative analysis, combustion spray seed oil kapok better than castor oil, this is indicated in the data there is a difference of 20.73% the length of the combustion spray maximum of coconut oil than jatropha oil, the burning of coconut oil reach flames maximum is 164 cm and oils a distance of 130 cm, for width measurement obtained difference of 23.60% a wide range of flame spray a maximum of coconut oil than jatropha oil, coconut oil range of flame spray a maximum of 33.7 cm and jatropha oil is 28.8 cm, and the results of the analysis phase of burning, coconut oil occurs twice burning while the jatropha oil are three stages of combustion.

*Keywords*: Coconut oil, jatropha oil, combustion spray



## 1.0 INTRODUCTION

Availability of fossil fuels are diminishing and causing very fluktuatis prices and the negative impact of fossil fuels to encourage authors to seek alternative renewable fuels. Research (1) Recently, a few studies several non-food raw materials in the production of biodiesel a promising future because it does not compete with food crops and do not increase food prices. Therefore, it is a key factor to ensure the economic viability of the production of biodiesel (2, 3) have reported that non-food vegetable oils have a lower price than the vegetable oil can be dimakan.Upaya have been made to develop non-edible vegetable oil derivative sifatdan approaching the performance of hydrocarbon-based diesel fuel. Some biodiesel that has been investigated and discussed is Jatropha, Pongamia pinnata, Calophyllum inophyllum, Hevea brasiliensis, Azadirachta indica, Madhuca indica, Sterculia feotida, Lesquerella fendleri, Ricinus communis L., etc. (4)

## 2.0 LITERATURE REVIEW

Coconut oil has the shortest carbon chains in the group of vegetable oils (5) and has a chemical structure similar to petro diesel. Thus, coconut oil suitable for Diesel engines. So far, the coconut oil used as fuel for non-premixed, for example in a pressure cooker (6) because the exhaust emissions are lower, more environmentally friendly, calorific value lower than diesel (7, 8, 9) However, coconut oil still can not be applied directly as a non-premixed in diesel engines because some disadvantages such as high viscosity, low volatility, largely composed by unsaturated long-chain fatty acids with the reactivity

is low, heating needs, atomization and particle emissions (10, 11). It would be useful if the oil can be burned in a premixed flame. In this case, the oil must be vaporized before injection into the combustion chamber. Loss of coconut oil was also caused by multi-kompone composed of various fatty acids with different properties and glycerol is very hygroscopic (12).

jatropa is a popular energy crops in tropical countries. The plant has several uses including energy supply that can be used in crude form as biodiesel. Since the last decade of the last century, or methyl ester biodiesel has become more attractive because of the environmental benefits and the fact that it is made from renewable energy sources in the article (13). The importance of biodiesel production from a total of 63 species with oil producing seeds, from 30 families of plants promising for the production of biodiesel (14). Rapeseed oil methyl ester was the first type of biodiesel fuel is produced commercially (15), biodiesel can be a good alternative on the machine marked as a raw material single can run the machine (16). Recent developments have made biodiesel economically attractive in the research potential and the possibilities for improving environmental performance, with job creation and rural economic empowerment (17). (18) conducted a comparative study of the various methods to improve engine performance using jatropha oil as the main fuel in compression ignition engines. Crude jatropha oil resulted in slightly reduced thermal efficiency.

Dilution, micro-emulsification, pyrolysis and transesterification are four techniques that are applied to solve the problems faced by high fuel viscosity (19) to study the performance and emission characteristics of biofuel comparable to material fossil fuels (20) J. curcas L. seeds have a high oil content and biodiesel produced has properties similar to petroleum-based diesel (21) biodiesel which generally cause an increase in emissions of NOx and reduction in HC, CO and PM emissions compared to diesel. Reported that diesel engines without modifications to be run successfully on a mix of 20% biofuel and 80% diesel fuel without damaging the engine parts (22) on the results of another study found that the production of biodiesel from J. curcas offers many social benefits, economic and the environment for the country and could play a big role to solve the problem of energy crisis (23). According to a report presented clear that finding a profitable source of biodiesel and should focus on the raw materials that do not compete with food crops, do not lead to land clearing and provides a reduction in greenhouse gases. (24) J. curcas L. seeds has a high oil content and biodiesel produced has properties similar to petroleum-based diesel (25).

## 3.0 METHODOLOGY

This research used coconut oil and jatropha oil in the spay at 1900 psi pressure by using a nozzle tester, the rear nozzle in length gauges are used to compare the length and width of fire. the results of the oil spray in turn by fire at the end of the nozzle so that the oil burned in the free air space, at the time of burning oil, a video camera recording the flame with a speed of 420fps from the side.

On the video recording is processed using software makers into a video recording of the picture frame, this method was also developed (26, 27), but in this study who used burning tool developed using the tester to make a spray nozzle. To analyze the differences in the maximum length of flame spray coconut oil and jatropha oil on the frame image can be seen the length of existing of the gauge length and can be specified length of the fire, and to analyze the width of flame spray can use comparison hasi measuring the length and width of fire results of image frames. As for determining the analysis phase of combustion can be seen from the character shape image frame flames if a fire burning in one step then forms the flame will move the oval and the way forward flames and to blaze occurred several stages of image frames fire will move forward later at some stage will retreat and then fire will move back up a few steps.

## 4.0 RESULTS AND DISCUSSION

The data collected from experiment will be analyzed and discussed.

### 4.1 The Levels of Fatty Acids in Coconut Oil and Jatropha Oil

On Tablel.1. Data composition of coconut oil from the results of laboratory tests obtained data is not much different from some referesi (28, 29, 30, 31) value is the weight of the fatty acids of the three biggest there is lauric 45.64 - 55.50% w / w both myrisic 14.90 - 22:10% w / w and the third is palmitic 6:40 to 11:10% w / w

**Table 1** composition of coconut oil

| NO | Fatty acid | Formula | Coconut oil % (w/w) |
|---|---|---|---|
| 1 | oleic | $C_{18}H_{34}O_2$ | 10.29 |
| 2 | linoleic | $C_{18}H_{32}O_2$ | 0.04 |
| 3 | palmitic | $C_{16}H_{32}O_2$ | 9.93 |
| 4 | palmitoleic | $C_{16}H_{30}O_2$ | 0.05 |
| 5 | lauric | $C_{12}H_{24}O_2$ | 43.76 |
| 6 | myristic | $C_{14}H_{28}O_2$ | 16.77 |
| 7 | caprylic | $C_8H_{16}O_2$ | 6.02 |
| 8 | capric | $C_{10}H_{20}O_2$ | 5.47 |
| 9 | stearic | $C_{18}H_{36}O_2$ | 2.81 |
| 10 | linolenic | $C_{18}H_{30}O_2$ | 0.04 |

On Table 2. the composition of the oil of jatropha oil from the results of laboratory tests obtained data that is not much different from referesi (32, 33, 34) value is the weight of the fatty acids there are three that the biggest is oleic 17.4 - 29.69% w / w both linoleic 35.11 - 53.76% w / w and the third is palmitic 2:46 to 23:20% w / w.

When compared to the composition of coconut oil and jatropha oil in tabel.1. and Table 2. There are considerable differences in the composition of oleic and linoleic. in coconut oil are oleic 10:29% w / w, while the castor oil are oleic 45.27% w / w. Linoleic on coconut oil 12:04% w / w, while linoleic oil 37.35% w / w. It is estimated lead to differences in results spray burning coconut oil and jatropha oil.

**Table 2** composition of jatropha oil

| NO | Fatty acid | Formula | Jatropha oil % w/w |
|---|---|---|---|
| 1 | oleic | $C_{18}H_{34}O_2$ | 45.27 |
| 2 | linoleic | $C_{18}H_{32}O_2$ | 37.75 |
| 3 | palmitic | $C_{16}H_{32}O_2$ | 14.94 |
| 4 | palmitoleic | $C_{16}H_{30}O_2$ | 0.84 |
| 5 | lauric | $C_{12}H_{24}O_2$ | 0.62 |
| 6 | myristic | $C_{14}H_{28}O_2$ | 0.34 |
| 7 | caprylic | $C_8H_{16}O_2$ | 0.08 |
| 8 | capric | $C_{10}H_{20}O_2$ | 0.08 |
| 9 | stearic | $C_{18}H_{36}O_2$ | 0.11 |
| 10 | linolenic | $C_{18}H_{30}O_2$ | 0.20 |

## 4.2 Frame Flame Combustion

In Figure 1, the method compares the combustion stage in the research conducted at any particular time (35) which take as much as 52 points were measured along spray so that the experimental results can be used for modeling, research (36) also using image capture using flame-shaped pattern that is used to determine the speed of the fire extends. In the analysis of long comparisons Figure 1. (a) the results of measurements of long range fire spray coconut oil (top figure) obtained maximum 164 cm and in measuring long range fire spray jatropha oil (below) obtained maximum 130 cm and for comparisons width (b) the results of measurements of a wide range of flame spray oil (top figure) obtained maximum 33.7 cm and in a wide range of measurement spray fire jatropha oil (below) obtained maximum 28.8 cm.

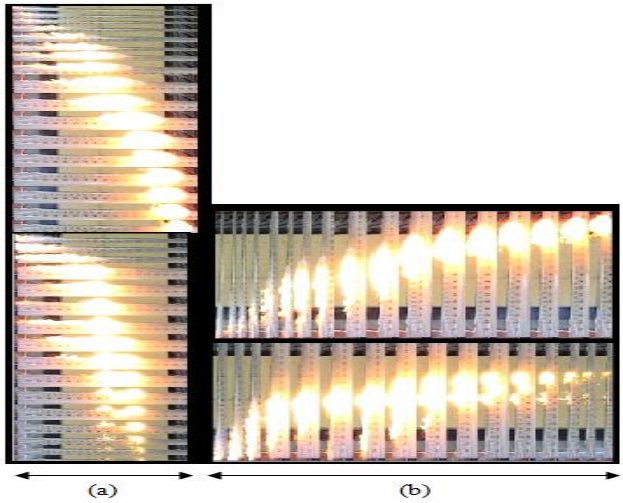



**Figure 1** Comparison of length (a) and width (b) spray fire between coconut oil and jatropha oil

Analysis in Figure 2. For stage flame spray on coconut oil occurs twice this stage can be seen in the picture for the first phase (i) the image that the movement of the flames gradually advanced from below to above and the fire at the beginning of the small picture and then move enlarged up then tapers flame. In stage two (ii) at the beginning of the fire retreated enlarged image from the bottom and then move the enlarged until then shrink and discharged fire flames.

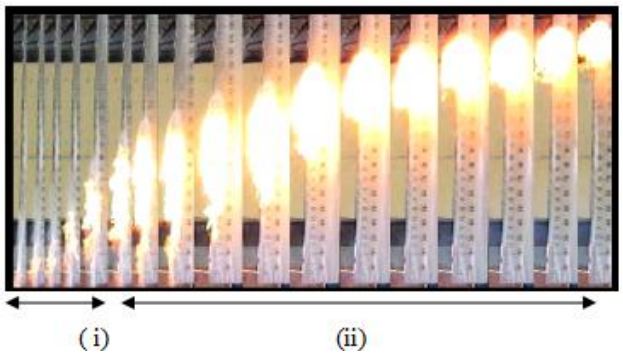



**Figure 2** Stages flame spray on coconut oil

Analysis in Figure 3. This method is used (26) on the burning of the oil droplets within the frame video recordings captured images produced two stages of combustion, flame spray to stage jatropha oil are three stages of this can be seen in the figure for stage one (i) the image that the movement of the flames gradually advanced from below to above and the fire at the beginning of the small image and then move the enlarged until then tapers flame. In stage two (ii) at the beginning of the fire retreated enlarged image from the bottom and then move the enlarged until then shrink and discharged fire flames. Finally in the third stage (iii) at the beginning of the

fire retreated enlarged image from the bottom and then move split up and shrinking and discharged fire flames

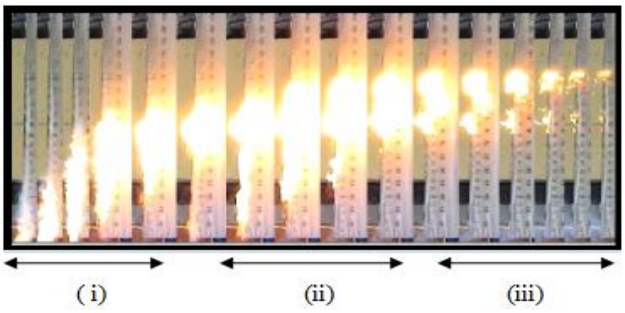



**Figure 3** Stages of flame spray on jatropha oil

## 5.0 CONCLUSION

On paper comparative analysis of combustion spray coconut oil and jatropha concluded:

1. At a pressure of 1900 psi and a speed of 420 fps video camera can be difference of 20.73% in the long combustion maximum spray oil than jatropa oil, coconut oil on the burning flames reach the maximum is 164 cm and jatropha oil that is 130 cm.
2. At a pressure of 1900 psi and a speed of 420 fps video cameras gained 23.60% difference in the width of the range of fire of coconut oil than the maximum spray jatropha, coconut oil spray flames reach a maximum of 33.7 cm and jatropha oil is 28.8 cm.
3. At a pressure of 1900 psi and a speed of 420 fps video camera in coconut oil combustion can occur twice in jatropha oil combustion, while there are three stages of combustion.

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