# Investigation on Properties of Jatropha oil from storage of seed, oil and different storage tanks at different period

Chanakan Puemchalad[1]*, Thanita Sonthisawate[1] and Piyanan Sreesiri[1]

## Abstract

The study of storage time for both Jatropha seed and (extracted) oil were conducted in parallel. The storage durations for the seed were 0th, 1st, 3rd, 6th, 10th, 12th, 15th, 18th month. This Jatropha seed was extracted by screw press and storage time for the extracted oil was 24 months except extracted oil from seed at 15th, 18th month which storage time of extracted oil was 9 months because of the ending of this project. Consequently, certain amount of Jatropha seed at month 0th was sampled and extracted, then properties of extracted oil, i.e. water content, acid value and oxidation stability, were analyzed and recorded. Jatropha oil from seeds those stored durations reached the 0th, 1st , 3rd, 6th, 9th, 12th, 15th and 18th month were sampled, extracted analyzed and recorded. Water content, acid value and oxidation stability, of oil extracted from seed at month 0th were 0.07 % (wt.), 1.31 mg of Potassium/ gm. oil, 13.9 hours respectively. Water content and acid value of Jatropha oil extracted from seed at month 18th were 14.29 and 129.77 % higher than those extracted from seed at month 0th, but the oxidation stability was 39.21 lower than oil extracted from seed at month 0th.

Then, investigation Jatropha oil storage times are 2 samples, A and B. They were bought from 2 companies. They are kept in plastic tank and zincs tank. The storage times are 0, 1, 3, 6, 9, 12, 15, 18, 21, 24 months respectively. When the storage time is duration, they are took sample A and B to analyze acid value, water content and oxidation stability.

The analysis result of sample A which is kept in plastic and zinc tank on 0 month. It is found that acid value is 2.34 mg of potassium/ gm. oil and oxidation stability is 12 hrs. Sample B is kept in plastic and zincs tank on 0 month. It was found that acid value is 5.85 mg of potassium/ gm. oil and oxidation stability is 7.68 hrs. However, the same values of water contents are 0.09 %. After that, the storage times past 24 months. The analysis result of sample A and B are kept in plastic and zinc tank found that the sample A, acid value is increase and percents of increase are 33.70 and 35.0., the oxidation stability is decrease and percents of decrease are 35 and 40.67. Anyway, the water contents are same increasing percent, 11.11. The sample B, acid value is increase and percents of increase are 31.28 and 33.33., the oxidation stability is decrease and percents of decrease are 23.83 and 30.34. Anyway, the water contents are same percent increase, 11.11.

**Keywords:** storage Jatropha, various times, acid value, oxidation stability, plastic tank, zincs tank.

[1] **Expert Center of Innovative Clean Energy and Environment Thailand Institute of Scientific and Technological Research (TISTR)**

**35, Mu 3, Khlong Ha, Khlong Luang, Pathum Thani 12120 Thailand**

**Tel: +662 577 9496 Fax: +662 577 9506, MP: +668 1832 9782**

***Contact person: chanakan@tistr.or.th**

## Introduction

Nowadays, there is the idea to encourage farmers to use raw materials in the country to produce as alternative energy to replace petroleum. Jatropha is another alternative to use as renewable energy for agricultural machinery [1] or for use as raw materials for biodiesel production. At this time, bio-energy from agricultural materials is still more expensive than diesel because the output of production is still low compared to the quantity in terms of fuel needed for industrial investment. Jatropha is a type of vegetable oil that can be extracted for oil used in diesel engines.[2] When the diesel engine is powered with Jatropha oil, its performance and fuel consumption will not be affected when returning to use diesel. For this reason, it has received attention from many groups to use Jatropha oil as biological energy. [3] Therefore, the properties of Jatropha seeds and oil and different storage tanks at different periods are studied. The objective of this project is to study the properties of Jatropha oil stored at various time intervals, and the Jatropha oil stored in different storage tanks. The scope of the study is to analyze the Jatropha oil stored at different time intervals, to analyze for the properties of Jatropha oil stored plastic and zinc tanks such as acidity, water content, and oxidation stability. [4] [5] The three important properties, if do not meet the requirements, will adversely affect engine components. For example, if the acidity is higher than the specification, will result in corrosion in the engine causing the life cycle of the pump oil filters to shorten. [6] It also shows the deterioration of oil due to the hydrolytic reaction from the amount of water mixed in the oil and the effect of storage conditions. As for the amount of water, if higher than the specifications, it will result in corrosion to the engine. And it is also a catalyst for oxidation reactions which is one of the causes of clogging in the nozzles. [7] As for the benefits derived from this project are information regarding duration and type of storage tank for Jatropha seeds and oil and different storage tanks in order to study the properties of Jatropha oil from various seeds that stored at different times

## Methods and materials, equipment, chemicals

### 1. Extraction of Jatropha oil using a screw press extraction

1. Jatropha seeds used in this experiment are stored in a total duration of 18 months. However, the extraction duration of Jatropha oil, the seeds stored at 0, 1, 3, 6, 10, 12, 15, and 18 months will be extracted so that Jatropha oil extracted will be stored for a period of 24 months. Except for Jatropha seeds stored at the 12, 15, and 18 months, the oil extracted will be stored for only 9 months because of the ending of the project. In this extraction, the screw press machine of the Engineering Department Thailand Institute of Scientific and Technological Research will be used.

2. Before extracting, Jatropha seeds must be baked with the heat at 60-70°C for easier extraction using the UNB400 oven, MEMMERT brand. And after baking, it will be stored into the desiccator to cool then Jatropha seeds will be extracted

3. Jatropha oil obtained from this extraction method will be filtered or left to precipitate before continuing to further experiment

### 2. Experimenting of Jatropha seeds storing

1. Jatropha seeds are stored at various in-

tervals from the 0, 1, 3, 6, 10, 12, 15, 18 months, respectively.

2. When the Jatropha seeds are stored after the specified time. The Jatropha seeds will be extracted for oil with a screw press machine, and then filtered to remove the sludge.

**3. Storage of Jatropha oil obtained from oil extraction**

1. Bring Jatropha oil obtained from squeezing the seeds in section 2.2 for storing at various intervals from 0,1,6,9,12,15,18, 21 and 24 months respectively by dropping into a 5-liter white plastic tank and tightly close the lid. 2. Analyze the properties of Jatropha oil extracted from 1 as follows; acidity value (ASTM D 664) using the Auto-Metric Titrator model DL53, Mettler Toledo (Thailand) Co., Ltd.; stability to oxidation (EN 14112) using the Rancimat model 743, Metrohm Siam Co., Ltd.; water content (EN ISO 12937) using the Karl-Fisher Titrator Model 831 KF Coulometer, Mettler Toledo (Thailand) Co., Ltd.; water and evaporation contents at 105°C (TIS. 44: 2516) using the oven, Model UNB 400, MEMMERT brand; Wij iodine value (AOAC 993.20); specific gravity at 25 C (TIS 44: 2516) using a Hydrometer; viscosity at 25°C (ASTM D 445); color (Lovibond scale) (TIS. 44: 2516); free fatty acids (AOAC: 2005); saponification number (AOAC 920.160); composition of fatty acids (AOAC: 2005). From the analyzed properties of the oil above, to study the properties of Jatropha oil that varies by the duration of the Jatropha seeds and oil storage.

**Results and Discussion**

**1. Results of storing Jatropha seeds and oil at different intervals.**

The results of the analysis of the properties of Jatropha oil stored in the period of 0-18 months indicate that the main components of fatty acids consist of the following; palmitic acid (C16: 0), 14.20-14.40 percent; stearic acid (C18: 0), 6.50-6.60 percent; oleic acid (C18: 1),46.0 - 46.30 percent; and linoleic acid (C18: 2) 30.50 - 30.81 percent, respectively.This is indicated that the Jatropha oil contains more than 98 percent unsaturated fatty acids, making it easier to oxidation reaction when exposed to sunlight, oxygen or heat. Therefore, the stability to the oxidation reaction of Jatropha oil is further studied and it is found that the stability to oxidation is about 13.90 hours for seeds stored at 0 months and oil stored at 0 months. And when the storage period reaches until the 18th month and the oil storage reaches the 9th month, the stability to oxidation of Jatropha oil decreases to 8.75 hours. Comparing to the stability to oxidation of crude palm oil it is as low as twice times. This is due to crude palm oil contains fatty acids which are mostly saturated fatty acids and also contains beta carotene, an antioxidant which helps inhibit oxidation. In addition, as the duration increases, the amount of water and acid also increases. But the amount of water increased only slightly, from 0.07% to 0.08% because Jatropha oil receives the moisture from the air above the oil surface and the increased acid content as a result of the free fatty acid content in Jatropha oil. It also shows the deterioration of the oil due to the hydrolytic reaction from the amount of water contaminated with oil and the results of storage conditions

In addition, the iodine value can also reflect the number of double bonds or unsaturated fatty acids of the oil. If the oil contains higher iodine, it can reflect a higher amount of dou-

ble bonds or higher unsaturated fatty acids. For Jatropha oil with higher iodine values, for example, greater than 90 gramsIodine/100 grams sample, it shows that there is a high double bond amount or higher content of unsaturated fatty acids and it also shows a much faster polymerization reaction than vegetable oils with lower iodine values when compared with crude palm oil having an iodine value of approximately 50-60 and contains lower unsaturated fatty acids (Phitsamai Chenwanitpanchakun et al. 2009)

From the storage of Jatropha oil at various time intervals, the analysis results of Jatropha oil obtained from the screw press method reveal that the factors that change over time are water content, acid value and stability to oxidation at 110 °C. Therefore, the comparison between the different storage periods of Jatropha seeds from 0-18 months and the storage periods of Jatropha oil from 0 - 24 months are conducted as shown in Figure 1-3.

The graph in Figure 1,2,3 shows the amount of water, the value of acid and stability to oxidation at 110C of Jatropha oil for seeds stored from the 0th to 18th month and the Jatropha seeds stored during the period from 0,1,3,6,10,12,15,18 months are extracted for oil.

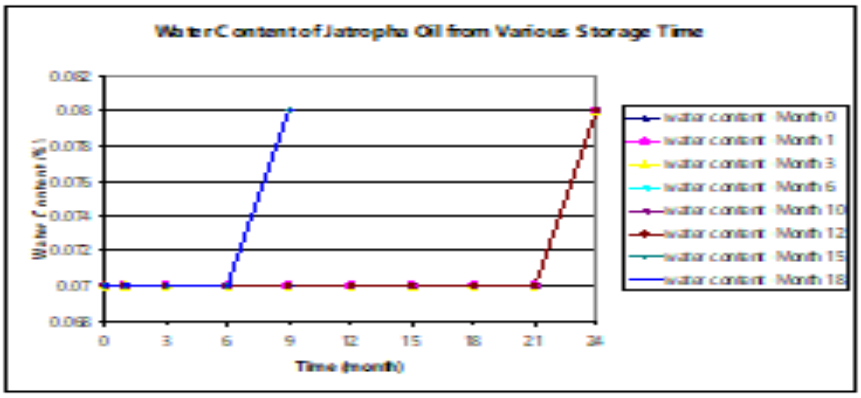


**Figure 1.** The water content in Jatropha oil for the period from 0 - 24 months

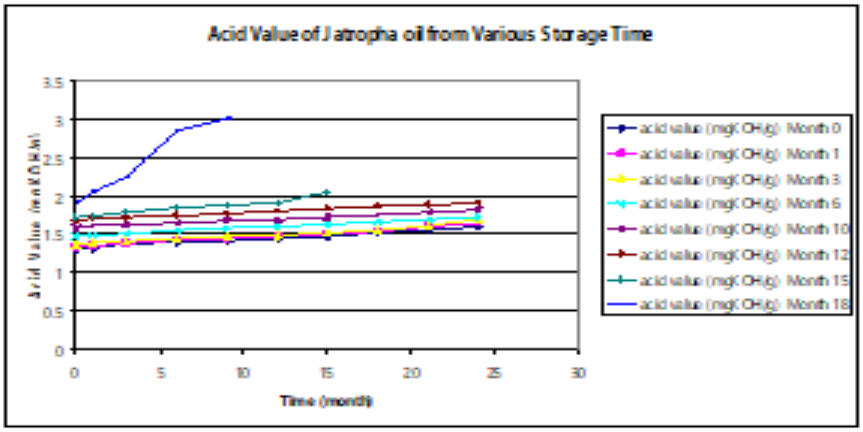


**Figure 2.** The acid value of Jatropha oil at the period from 0 - 24 months

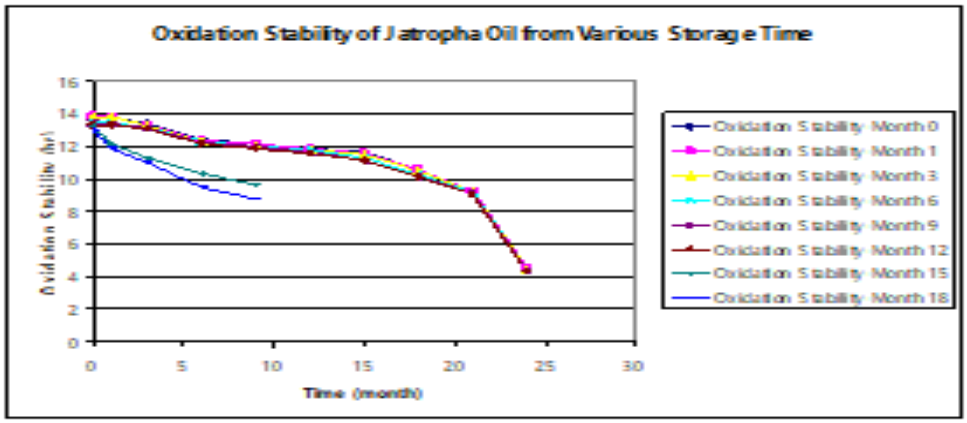


**Figure 3.** Stability to the oxidation at 110C of Jatropha oil at the period from 0 - 24 months

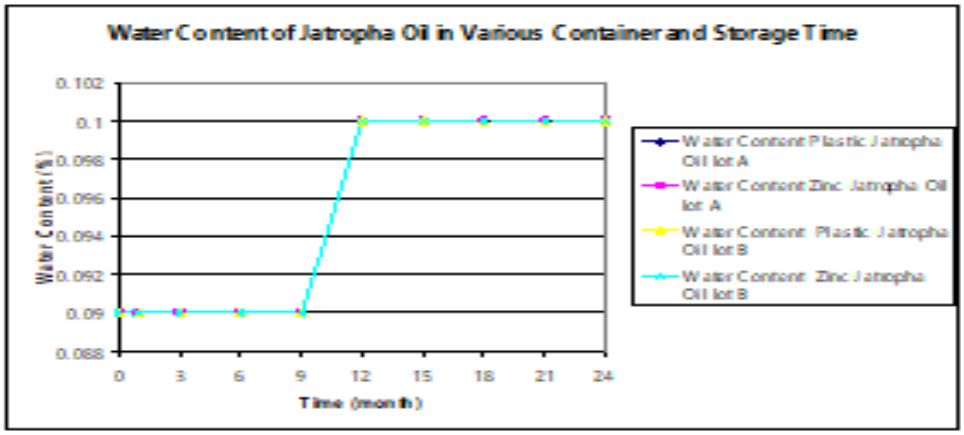


**Figure 4.** The water content of Jatropha oil of sample A and B in plastic and zinc containers during the period 0 - 24 months

And when extracting Jatropha oil from the seeds stored as above periods, then the Jatropha oil will be stored for 24 months except the Jatropha oil from the seeds stored at 15 and 18 months in which the Jatropha oil can only be stored for 9 months due to the ending of the project. As for evaluating the properties of oil stored for 24 and 9 months, the test will be conducted for the following periods including 0,1,3,9,12,15,18, 21, 24 months. From graph 1, it can be seen that the content of water increases slightly, that is from 0th month with the water content of 0.07 percent until the 24th month with the amount of water of 0.08 percent. The graph in Figure 2 shows the acid value of Jatropha oil which can be seen that when the duration of the storage of Jatropha seeds and oil increases, the acid value of Jatropha oil increases accordingly. And from graph 3, it indicates the stability to oxidation at 110 °C of Jatropha oil which can be seen that when the storage time of Jatropha seeds and oil storage time increases, the stability to the oxidation at 110 °C decreases too. Therefore, the storage duration of Jatropha seeds and oil should not be too long because the properties of Jatropha seeds and oil cannot be used for the engine or cannot produced as biodiesel that meets the quality standards while it will waste chemicals for the production of biodiesel that meets the quality standards.

**2. Effects of storing Jatropha oil in plastic and zinc tanks at different periods**

From Figure 4, it shows that water content of Jatropha oil A and B samples in plastic and zinc tanks stored at 0-24 months represent the same changes in both A and B samples, that is, during the initial period, the water content is lower and when the period of storage increases, the amount of water increase only slightly since the oil receives moisture from the air above the surface of the oil. Figure 5, shows that the acid content increases with increasing duration. Such increased acid content is the result of the free fatty acid content in Jatropha oil. It also shows the deterioration of oil due to the hydrolytic reaction from the amount of water mixed in the oil and the effect of storage conditions. And from Figure 6, it shows that the stability to oxidation at 110 °C which decreases due to the increased amount of free fatty acids in Jatropha oil.

**Summary**

**1. Effects of Jatropha seeds and oil storage at different periods**

The results of Jatropha seeds and oil storage at different periods, it is found that the Jatropha seeds and oil storage at the 0th month are stable to the oxidation of 13.90 Hours, the acid value is 1.31 mg potassium per oil gram and water content is 0.07 percent. And when the

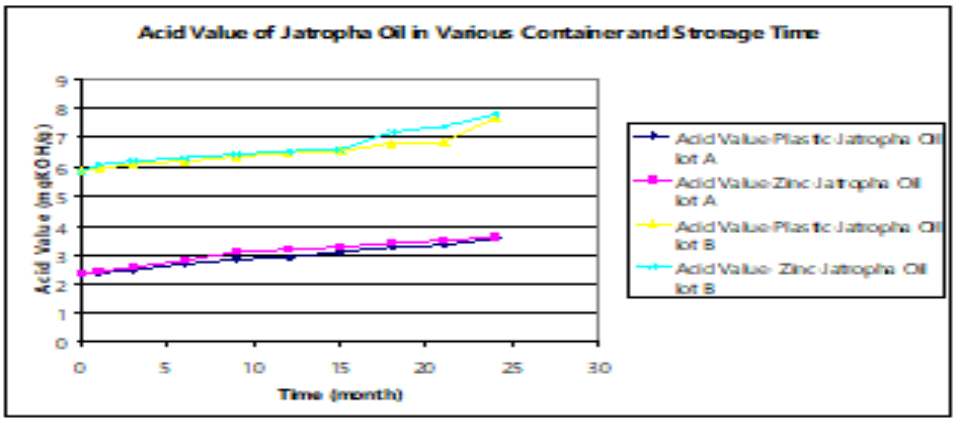


**Figure 5.** Acid values of jatropha oil of sample A and B in plastic and zinc containers during 0-24 months

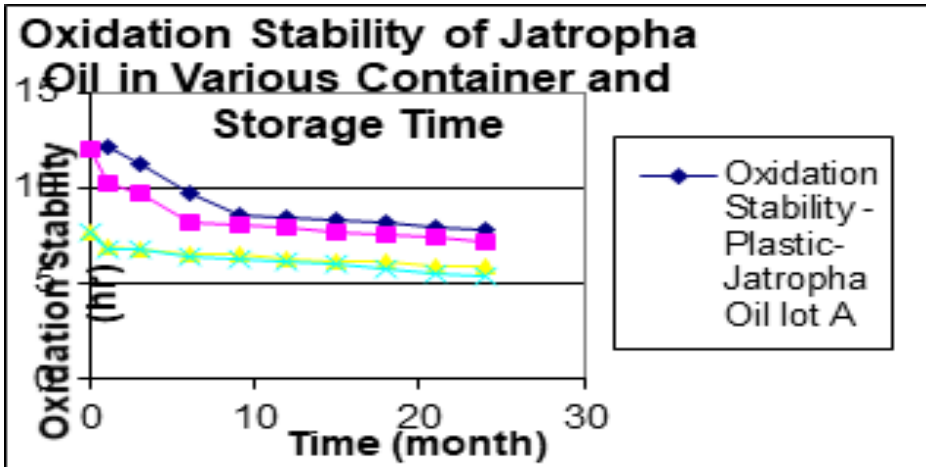


**Figure 6.** Stability to oxidation at 110°C of Jatropha oil of samples A and B in plastic and zinc containers at 0 - 24 months.

Jatropha seeds storage period reaches18 months and the oil storage period reaches 24 months, the composition of fatty acids changes slightly, but the values of acids, water content, and stability to the oxidation change as follows; the acid value after 24 months, the acid content increases from 1.31-3.01 mg potassium hydroxide/gram accounting for 129.77% increased; the amount of water increases only slightly, from 0.07-0.08%, representing 14.29% increased; and the oxidation stability at 110 °C decreases from 13.90 - 8.75 hours accounting for 37.05% increased.

**2. Results of storage of Jatropha oil in plastic and zinc tanks at different periods.**

The results of storage of Jatropha oil sample A and B, stored in plastic and zinc containers for a period of 24 months indicate that; sample A of Jatropha oil stored in a plastic container has the acid content increased from 2.34 to 3.55 milligrams potassium per gram oil accounting for 33.70% increased, the value of water content increases from 0.09 - 0.1% accounting for 11.11% increased and oxidation stability decreases from 12 to 7.80 hours accounting for 35% decreased. For the results of the storage of sample A of Jatropha oil in the zinc container for 24 months, the results indicate the same trend as the Jatropha oil stored in the plastic container. That is, the acid value increases from 2.34 to 3.59 milligrams potassium per gram oil accounting for 0.35% increased, the number of water increases from 0.09 to 0.1% accounting for 11.11% increased. The stability to oxidation decreases from 12 to 7.12 hours accounting for 40.67% decreased.

Results of storage of sample B Jatropha oil in plastic containers reveal that the acid content increases from 5.85 to 7.68 milligrams potassium per gram oil accounting for 31.28% increased. The water amount increases by 0.09 - 0.1 percent, accounting for 11.11% increased. And the stability to oxidation reaction decreases from 7.68 to 5.85 hours accounting for 23.83% decreased. For the storage of sample B Jatropha oil in a zinc container for 24 months, it indicates that the results provide the same trend as of the Jatropha oil storage in plastic containers, namely; the acid content increases from 5.85 to 7.8 milligrams potassium per gram oil accounting for 25% increased. While the value of water content increases from 0.09 to 0.1% accounting 11.11% increased. Oxidation stability decreases from 7.68 to 5.35 hours accounting for 30.34% decreased.

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