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The Basic of Mechanical Property of Palm Oil by Semi-damp Drying Process

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ABSTRACT

This project aims to develop the community palm damp dryer by improving from the ordinary palm dryer. By using the aerosolized technical the 100 °C hot water was sprayers as a humidifier for the palm in the dryer. The purpose was reduced palm fruit hardness. The results from the development shown that a damp palm with 41.28%RH (average humidity) required 0.28 kN of compression force. While a damp palm with 33.97%RH (average humidity) required 0.75 kN of compression force. A damp palm with 30%RH (average humidity) requires 0.77 kN of compression force. On the other hand, a steamed palm (100% average humidity) required 0.20 kN of compression force while a dry palm (18% average humidity) required 0.83 kN of compression force A dry palm required higher force because the humidity decreased in a palm fruit made it dry and hard. On the contrary, a damp palm required medium force and similar to a steamed palm because of their identical property. The results show that the optimal humidity was 41.28%RH.Moreover, the experiments of basic properties of palm oil were free fatty acid (FFA) and DOBI. It was found that the FFA of palm oil from semi-dampness process was lower than drying process; the DOBI of palm oil from semi-dampness dry process was higher than dry process.

Type of Paper: Conceptual / Empirical/other.

Keywords: Palm Oil; Semi-damp Drying; Hot Air Drying; Palm Oil Drying; Semi-dampness dry process.

1. Introduction

The oil palms were first planted in Thailand in 1929 by planting as decorative plants in Kho Hong Rubber Experimental Center, Songkhla Province, and Phliu Agricultural Station, Chanthaburi

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Province. However, the oil palms were promoted to be really planted in the area in 1968 at the Self Settler in the development of the southern region, Satun Province, in the area around 20,000 rai. At present, the oil palms are considered the economic plants which can generate the sustainability in food and energy. They are popularly planted in nearly all regions of Thailand. The farmers in each region and each locality are encouraged to plant the oil palms more. The palm oil is extracted from the oil palms giving the oil in the amount as high as 0.6-0.8 tonnage/field/year. When compared to other oil plants, it can be used in the food industry and used in cooking as it has the property of high heat resistance and does not contain carcinogen. The palm oil is cheaper than other kinds of vegetable oil. Moreover, the oil palms are the plants free from GMOs. The palm oil can be produced domestically. The use of oil palm will result in the added value and the gross revenue of the country [1]. Many researchers have studied about palm oil [2-6].

1.1 Reasons for palm bunch drying

1.1.1. Helps inhibiting the free fatty acids generated in the palm fruits and to get the most effective oil.

1.1.2 Make the palm fruit fall off from the bunch easily.

There are two ways to make the palm fruits, ripe and easy to leave the bunch; steam the palm bunches and hot air drying process. Ekarat Vaiyanitet al.[7] developed the new system of palm bunch drying without using the steam. This helps removing the moisture from the palm, makes the palm off the shell more easily, and also inhibits the formation of free fatty acids. Therefore, the palm oil has good quality in A grade with low humidity and low fatty acids. In the last step, there is no need to chase away moisture from the oil again. It can save energy. And when not using water in the production process, it does not cause wastewater. Boonyarak Kanchanaworavanich [8], National Institute for Materials Science, 2005, analyzed the advantages and disadvantages of steamed and non-steamed palm bunch drying.

Steaming is the technology which most factories popularly use. The palm oil extraction process will use the hot steam in stopping the reaction of Free fatty acid in the palm fruits helping the fresh palm bunches soften and off the shell more easily. Then split the palm fruits and bunch apart. Put the palm fruits into the steamer in order to make palm meat fall out of the palm shells in the palm. The separated palm will be sent to the crate for squeezing the CPO (crude oil palm). The crude palm oil is obtained through filtration, settling, and others produce crude oil. Finally, it will pass through the dehumidifying process from the palm oil. The advantage of the system is that the extracted product is the A grade palm oil with the quality and properties suitable to be used as raw materials in the serial industry such as biodiesel production or vegetable oil. The disadvantages are that in the production process, steam is used, resulting in wastewater and the extraction system consists of more tools and machineries which is more complicated.

Non-steaming is the extraction process starting from drying the palm fruits to reduce humidity and cease the reaction of Free fatty acid. Then, the dried palm fruits will be put into the crate to get the palm oil. The advantages are that the system is less complicated than the extraction system using steam, the palm meat residue can be sold or used as the feed, and there is no wastewater occurring in the production process. The generated palm oil is combined with the palm meat and seeds in the palm fruits having the Iodine value not suitable to be used in the refinement process. The oil will be downgraded to Grade B palm oil having the sale price lower than Grade A oil for around 1-1.50 baht per kg. Moreover, the machines used in the extraction system are more ruined as they are used in crating the palm meat and seeds (which are hard) at the same time resulting in quite high costs of repairing and maintenance.

From the problem found above, the researcher has realized the solution to the problem. The study is conducted to investigate the development of palm semi-damp dryer and the palms having been dried are tested on the physical properties of semi-damp dried oil palm in order to test the hardness of palm fruits and the DOBI value of the palm oil.

2. Test methods

In the palm semi-damp drying test, the palm bunch dryer is designed to have 3 steam nozzles near the entrance of the heat to increase the hot air and humidity for the palm fruit to ripen as shown in Figure 1. Each point is 25 cm apart and can be handled the palm bunch drying in the form of layer drying. The design of the spray head through the hot air can pass through all layers of palms at the same time. In warming the hot air, LPG is used as a source of heat to burn the steel plate fins installed to help making heat transfer for higher temperatures. In designing the drying chamber, it can be designed to be able to dry for at least 50 kgs / test. The duration of drying is 3 hours. The temperature used in drying is 65-70°C. The palms used for the test are Tenera varieties from the area of Kabin-Buri District, Prachinburi Province. In increasing the moisture, the boiling water can be increased at 99.7 °C and spray at 0.0006, 0.0008and0.001litre/s, respectively. Then, the palm fruits are tested for finding the pressure and the palm fruits are also crated in order to bring the oil to be tested for finding the FFA and DOBI value. The palm oils are used to test for FFA and DOBI. The test is for finding as follows:

2.1 Finding FFA

Prepare Sodium Hydroxide)NaOH) into the burette by weighing 0.4g of Sodium Hydroxide into the 250 ml shampoo bottle and pour 100 ml of pure refining water into the 250 ml shampoo bottle. Use the stirring rod to stir the solution to be mixed well. After that, pour it into the burette.

Bring the obtained palm liquid in the titrate process for finding FFA by putting the crude palm oil into the oven and setting the temperature at 115 ˚Cto dehydrate for 2 hours. Weigh 5 g of palm oil to put into the 250 ml shampoo bottle. Pour 50 ml of alcohol into the shampoo bottle containing the palm oil. Drop 4-5 drops of phenolphthalein solution into the bottle and perform the titrate process.

2.2 Finding DOBI

Put the obtained palm oil into Spectrophotometer to find DOBI by putting the crude palm oil into the oven and setting the temperature at 115 ˚C to dehydrate for 2 hours. Put the palm oil into the glass tube and measure the value by using Spectrophotometer.

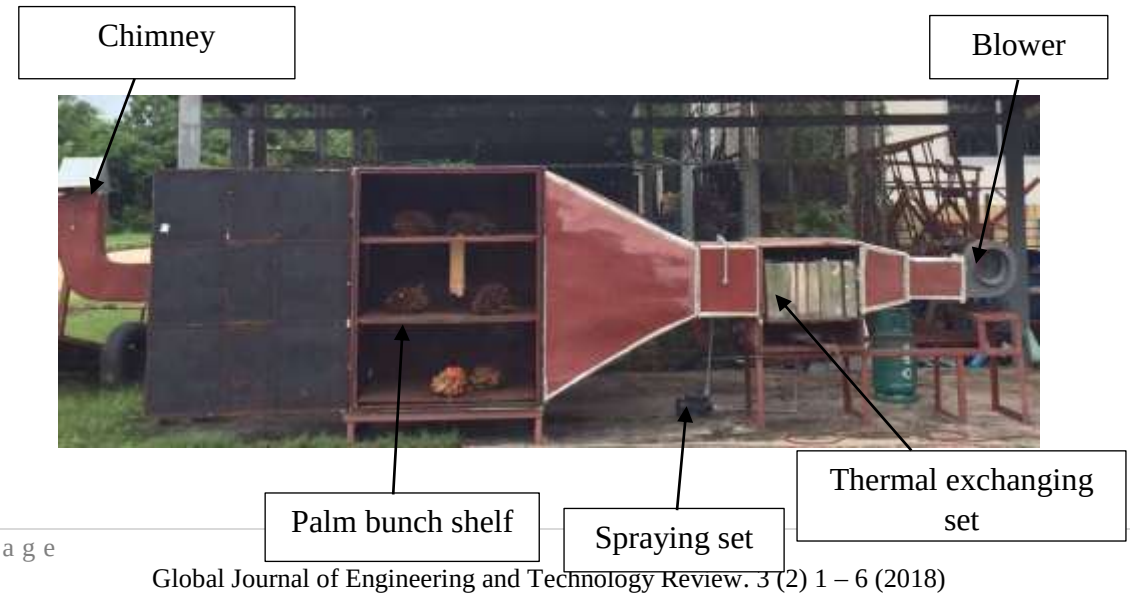

Figure 1. Parts of community palm semi-damp dryer

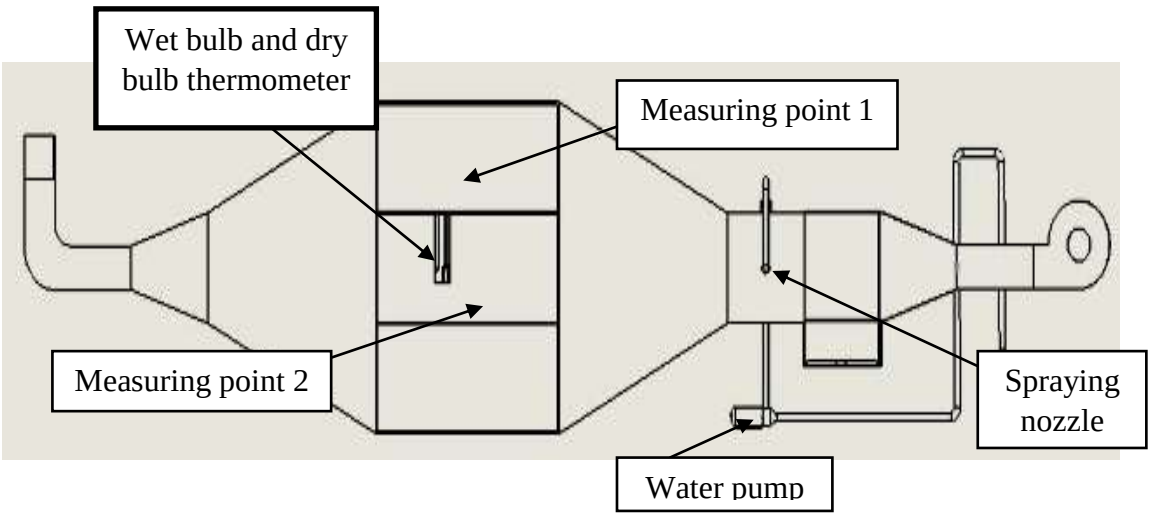

Figure 2 Illustration for the design of development of community palm semi-damp dryer

3. Results of the compression test of the palm fruit

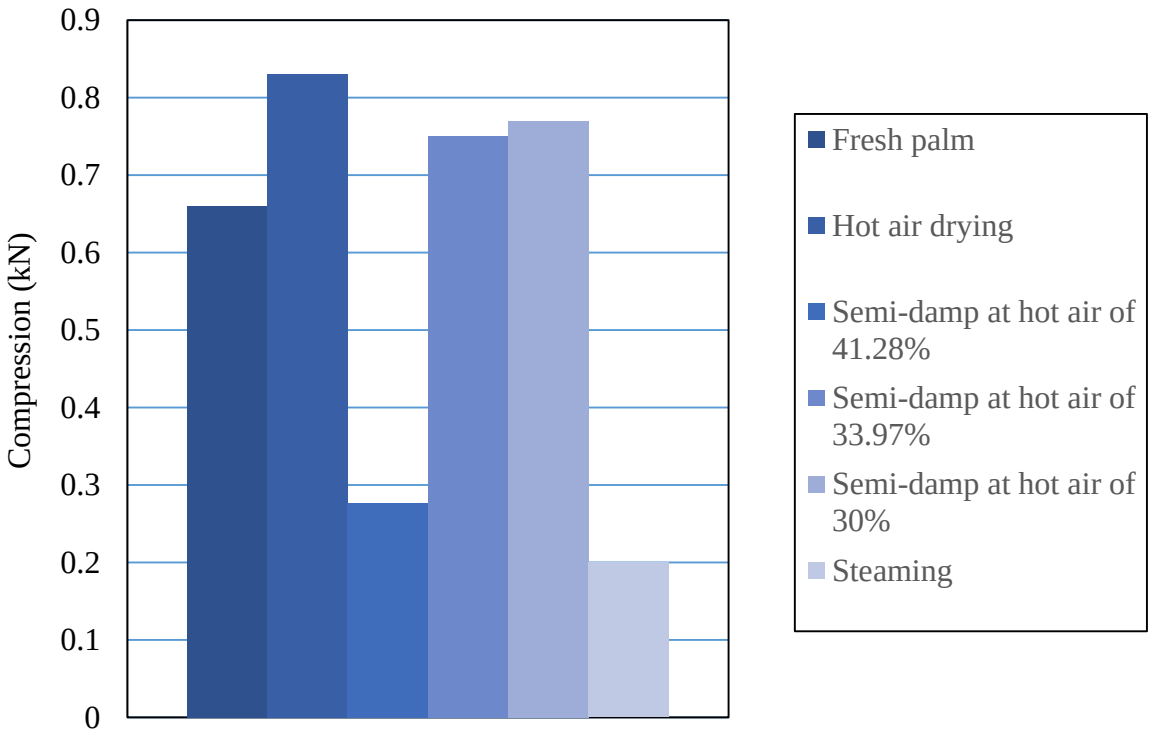

Figure 3. Graph representing the efficiency of palm seed compression test, the temperature in the oven at 70 ◦C

According to the data, the crude palm is found to use the average pressure of 0.66 kN. For the humidity of the hot air is averagely 18%, the average pressure to be used is 0.83 kN. For the semi-

damp dried palm fruits at the average hot air of 41.28%, the average pressure to be used is 0.28kN. In the semi-damp dried palms at the average hot air of 33.97%, the average pressure to be used is 0.75 kN. In the semi-damp dried palms at the average hot air of 30%, the average pressure to be used is0.77kN. For the steamed palm fruits with the humidity of the hot air of 100%, the average pressure to be used is0.20kN.According to the data, the steamed palm fruits are found to use the least pressure as steaming makes the palm fruits soft and require the least pressure. The dried palm fruits require much pressure because the humidity in the palm fruits are reduced, causing the palm fruits to be dried and hard. In the semi-damp dried palm fruits, the pressure to be used is moderate and most similarly to the steamed palms as the properties are similar to steaming and the humidity is best used at the temperature of 41.28%. Therefore, it can be concluded that palm semi-damp drying can reduce the pressure most similarly to steaming and it will also reduce the processes of water boiling as well as the occurrence of wastewater from palm steaming.

4. Results of analysis on the volume of free fatty acid)FFA(both for the hot air and the semi-damp drying

According to the experimental results, it is found that drying at the temperature of 70°C for 3 hours and leave it for 1 days in the method of semi-damp drying, % FFA is better than hot air drying because semi-damp drying can help stopping the lipolysis reaction better than the hot air drying. This is because the semi-damp drying will have the hot steam to penetrate into the palm fruits causing the palm meat gained from the semi-damp drying process ripe better than normal hot air drying resulting in the occurrence of free fatty acid in the palm fruits. The volume of free fatty acid in the oil indicates the oil quality to be produced as biodiesel or to be consumed. The high volume of free fatty acid will result in a natural oxidation reaction more easily causing the bad odor.

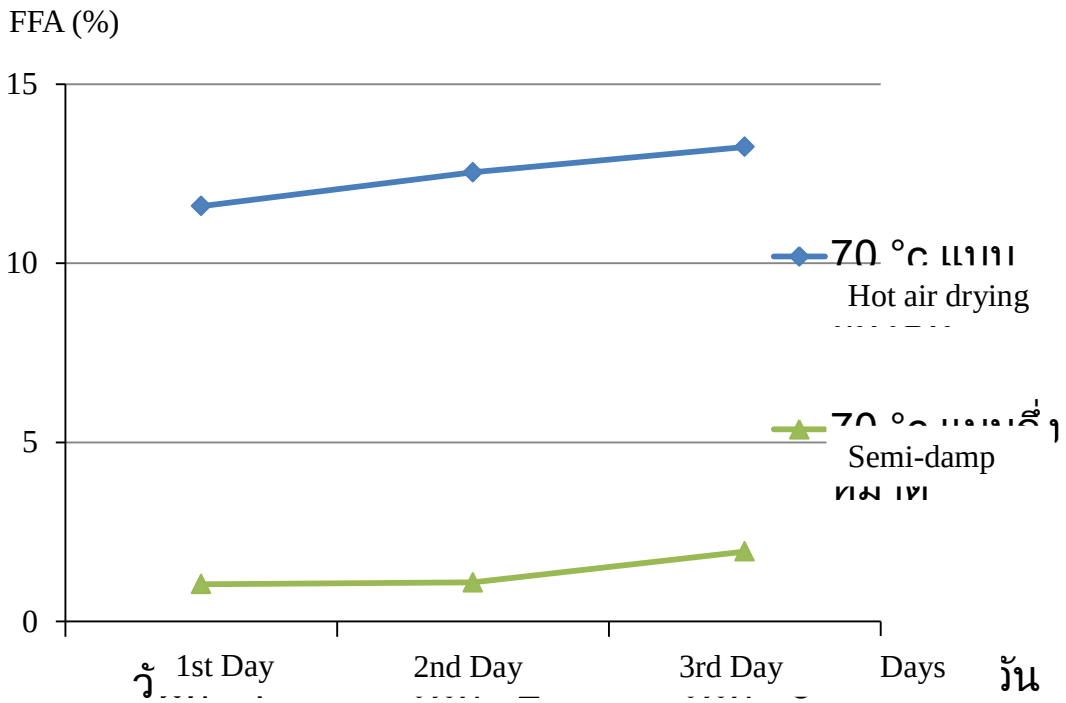

Figure 4. Presentation of FFA

5. DOBI in the palm oil

For the hot air drying, the crude palm oil is in the grade of palm oil residue. The oil grade is considered following the DOBI to consider the freshness of the crude palm oil. If it is lower than 2.2, it means the crude palm oil is not fresh. The oil is unsuitable for consumption. For semi-damp drying, the crude palm oil is in the grade of 2.31 - 2.92 whose quality is fair. It is considered that the palm fruits are ripe and the oil is suitable for consumption.

6. Conclusion of experimental results

According to the experimental results of the palm fruit pressure by randoming the palm fruits from palm drying using the community palm semi-damp dryer, it is found that at the humidity of hot air of 41.28%RH, the pressure is 0.28 kN. At the humidity of hot air of 33.97 %RH, the pressure is 0.75 kN. At the humidity of hot air of 30 %RH, the pressure is 0.77 kN. In dry air palm bunch drying at the humidity of 9 %RH, the pressure is 0.83 kN. For the palm bunch steaming at the humidity of 100 %RH, the pressure is 0.20 kN. It can be summarized that in increasing the humidity to the palm bunch drying, the pressure to be used with the palm fruits reduces and the best humidity used in this experiment is 41. 28%RH. From the test results, the semi-damp drying is recommended as the initial properties of the crude palm oil is in the grade higher than the crude palm oil obtained from the hot air drying.

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