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The Effect Of Ginger Variety And Incubation Time On The Quality Of Coconut Oil (*Cocos Nucifera*)

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Abstract: *Indonesia is the largest coconut producing country in the world. During this time, people process coconut oil in the traditional way. The oil quality is not good because it is processed by heating. One effort to get good quality coconut oil is to manage coconut oil without heating, namely enzymatic processing using zingibain enzymes from ginger. This research uses factorial randomized block design (RBD) consisting of two factors, namely ginger (J) type factors and duration of incubation (T). Ginger (J) type factor consists of two levels, namely: J1 = Zingiber officinale var officinarum and J2 = Zingiber officinale var rubrum. The incubation time factor (T) consists of three levels, namely: T1 = 36 hours, T2 = 48 hours, and T3 = 60 hours. The results showed that the type of ginger had a significant effect on yield, water content, acid number, and color organoleptic tests, but had no significant effect on the organoleptic scent test. The best treatment was obtained on coconut oil produced from Zingiber officinale var rubrum and 36 hours incubation time, with free fatty acids 0.19%, water content 0.24%, peroxide number 0.516 meq / 1,000 grams, yield 28.68% and had a total percentage preference for color 98.8% and aroma 51.1%.*

Keywords*: Coconut Oil, Enzymatic, Zingiber officinale var officinarum, Zingiber officinale var rubrum*

1. Introduction

Indonesia is a country that has the largest coconut plantations in the world with an area of 3.88 million hectares (97% is smallholder plantations) and produces 3.2 million tons of coconut equivalent to copra. In general, making coconut oil is done traditionally. However, high heating in the traditional way can change the structure of oil and produce oil color is not good, if tested the quality will have high levels of

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peroxide and free fatty acids so that oil will quickly become rancid and the manufacturing process is traditionally inefficient , because the work process is very dependent on sunlight (Jannah and Halim, 2014).

The purpose of this study was to determine the effect of adding the type of ginger filtrate on the quality of coconut oil, the effect of incubation time on the quality of coconut oil, the effect of the interaction of the addition of ginger filtrate with the incubation time on the quality of coconut oil, and knowing the financial feasibility of the coconut oil production process.

2. Theoretical Framework

Making coconut oil in general is traditionally processed using high temperatures can change the structure of oil and produce oil color is not good, so that research is done by utilizing enzymes as catalysts (Winarti et al, 2007).

The enzyme used is the protease enzyme. One of the plants that contains protease enzyme is an enzyme derived from the ginger rhizome which is the zingibain enzyme. According to Indonesian National Standard No. 01-2902-1992 The quality of coconut oil is determined based on water content, free fatty acid levels, peroxide numbers, saponification numbers, yields, and color and aroma organoleptic tests.

3. Research Method

3.1 Material and Equipment

The raw materials used in this study are old coconut and zingibain enzymes obtained from elephant and *Zingiber officinale var rubrum* filtrate according to the results of previous studies (Jannah et al, 2014), namely crude protease which is extracted directly from ginger rhizome with specific activity 0.032 unit / mg / min. Equipment used includes: pH meters, Ohaus analytical balance, filter paper, thermometers, beaker glass, erlenmeyer tubes, pipettes and equipment as well as chemicals for analyzing coconut oil quality.

3.2 Experimental design

This study used a factorial 3 x 2 Randomized Block Design (RCBD) consisting of two factors: the type of ginger (J) and the incubation time (T). Ginger type factor (J)

consists of two levels, namely: J1 = *Zingiber officinale var officinarum* and J2 = *Zingiber officinale var rubrum*, the incubation period (T) consists of three levels, namely: T1 = 36 hours, T2 = 48 hours, and T3 = 60 hours. Thus there are 6 treatment combinations and repeated 3 times to obtain 18 experimental units.

3.3 Coconut Milk Making Process

Making coconut milk begins with selecting old coconut, then mixed and extracted with water. Comparison of water and coconuts is 1: 1 (1 liter of water for 1 kg of coconut). Squeeze coconut milk by hand. Then coconut milk is filtered using a filter cloth.

3.4 The Process of Making Ginger Filtrate

The process of making ginger filtrate begins with the process of sorting ginger, then weighing. Ginger is peeled using a knife, then cleaned with flowing flow. Ginger filtrate is obtained by grating the ginger rhizome then squeezing it so that the ginger extract is obtained, then settling for 1 hour to separate the ginger filtrate and starch.

3.5 The Process of Making Coconut Oil

The process of making coconut oil is to take as much as 200 ml coconut milk cream and then added to the type of ginger filtrate according to the treatment as a source of the enzyme zingibain as much as 2 ml into an erlenmeyer tube. The mixture of coconut milk cream and ginger filtrate was then incubated at room temperature for 36 hours, 48 hours and 60 hours until coconut oil was obtained. In the tube, three layers will be formed, namely coconut oil, blondo and water. Take the topmost coconut oil by using a pipette slowly. Then filter the obtained coconut oil. Filtering is done using filter paper. This screening aims to separate coconut oil from protein (*blondo*) in order to obtain clear coconut oil (Hapsari and Welasih, 2010).

4 Results and Discussion

4.1 Water content

The results of analysis of variance in coconut oil water content showed that there was an interaction between the incubation length parameters and the type of ginger on

the water content. The histogram of the average interaction of coconut oil water content can be seen in Figure 1.

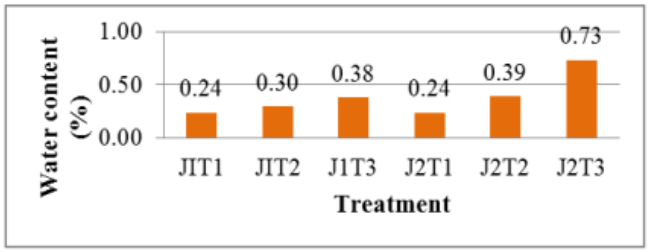

Figure 1. Histogram of average interaction of coconut oil water content

Figure 1 shows that the incubation time and type of ginger added can affect the water content produced. The longer the incubation time, the higher the water content obtained. Likewise, the addition / type of ginger can be seen by giving both types of ginger each giving an impact of increasing water content in each treatment. This is presumably because fresh *Zingiber officinale var officinarum* has a water content of 71.50% and fresh *Zingiber officinale var rubrum* 70.48% (Puji and Lestari, 2009), so the addition of ginger filtrate is thought to affect the water content in coconut oil.

4.2 Free Fatty Acids (FFA)

The results of analysis of variance in coconut oil FFA levels showed that there was an interaction between the incubation length parameters and the type of ginger on the water content. The histogram of the average interaction of FFA levels of coconut oil can be seen in Figure 2.

In Figure 2, it can be seen that the addition treatment of *Zingiber officinale var officinarum* and *Zingiber officinale var rubrum* filtrate as a catalyst is thought to cause the FFA content to increase. Long incubation causes higher free fatty acids. This is because the longer the incubation, the greater the water produced. The amount of water in the oil will occur the process of hydrolysis of oil to free fatty acids and glycerol so that the free fatty acids produced are higher (Ketaren, 2008).

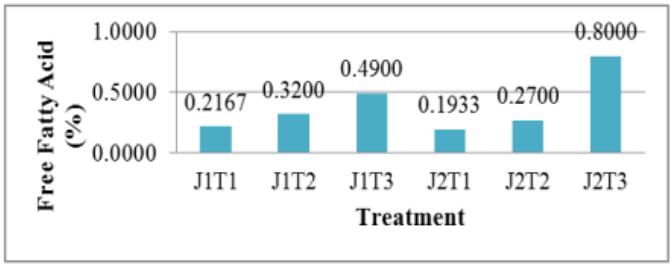

Figure 2. Histogram of Interaction of Coconut Oil free fatty acids

4.3 Peroxide Number

The results of analysis of various levels of coconut oil peroxide number showed that there was no interaction between the treatment of ginger type (J) did not significantly affect the peroxide number while the incubation time (T) significantly affected the peroxide number. Based on Figure 3. it can be seen that the peroxide number of coconut oil increased in T1 and T2 treatments but in T3 treatments it slightly decreased.

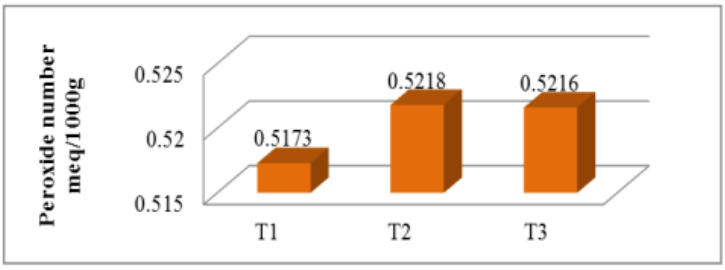

Figure 3. Histogram Mean peroxide number Treatment for Incubation Time (T)

The longer the incubation time, the free fatty acids of coconut oil produced increases, it will increase the peroxide number of coconut oil as Rasyid et al (2006) argued that if the peroxide number of an oil is high enough, then it can be said that the unsaturated fatty acids from the oil have been oxidized. It was also said that the higher levels of free fatty acids in oil would be followed by an increase in the number of peroxides. It was also reviewed by the analysis of free fatty acids that the curing period resulted in increased free fatty acids.

4.4 Saponification Numbers

The saponification test results show that the incubation time treatment and type of ginger have an influence on the coconut sap saponification rate. The longer the incubation time, the smaller the saponification number. This is because oils or fats are

hydrolyzed by enzymes released by microorganisms to become fatty acids, glycerol, water, and energy along with the incubation time, and ginger contains volatile essential oils which are volatile so it is suspected that the longer incubation time saponification value decreases due to the evaporation of ginger essential oil mixed with coconut oil. The low saponification rate is caused by the presence of long chain saturated fatty acids that make up the fatty acids that make up oil (Winarno, 2002)

The longer the fatty acid chain, the higher the molecular weight so that the oil saponification number will be lower. Therefore the longer the incubation process, the more fatty acids are formed and the smaller the number of saponification obtained. Besides that coconut oil is produced without going through a heating process so that the fatty acid content does not change (Fadlana, 2006).

4.5 Yield

The effect of ginger and incubation duration on the yield of coconut oil has a significant effect. This is because the longer the time provided, the more optimum the work of enzymes to damage the coconut milk emulsion into oil and water can be separated completely, so that it will affect the yield produced. This is in accordance with the statement of Campbell (2012), which states that the rate at which enzymes convert substrates into products is partly a function of the initial concentration of the substrate. The longer the time provided, the more optimum the enzyme works and the frequency of the rate of attachment of the substrate to the active side of the enzyme is greater and the amount of enzyme concentration, the coconut milk emulsion will be damaged and oil and water can be completely separated.

4.6 Color

Table 1.
Results of Total Preferred Level of Coconut Oil Color Parameters (%)

Skore	Neutral (3)	Like (4)	Really Like (5)	Total likes
J1T1	37,8	55,5	5,6	98,9
J1T2	30,0	61,1	6,7	97,8
J1T3	33,3	55,7	10,0	99,0
J2T1	21,1	56,7	21,1	98,9
J2T2	28,9	64,4	4,4	97,7
J2T3	27,8	67,8	3,3	98,9

nn

According to Erika (2014) color is a product trait that can be viewed as physical (objective) and organoleptic (subjective). Color can be measured or analyzed objectively with physical instruments and organoleptically or subjectively with human sensory instruments. Good coconut oil is clear yellow. The type of *Zingiber officinale var officinarum* and *Zingiber officinale var rubrum* filtrate and the duration of ripening can affect the color of the oil produced.

4.7 Aroma

Table 2.
Results of Total Preference of Coconut Oil Aroma Parameters (%)

Skore	Neutral (3)	Like (4)	Really Like (5)	Total likes
J1T1	44,4	12,2	0	56,6
J1T2	36,7	20	0	56.7
J1T3	40	20	0	60
J2T1	36,7	14,4	0	51,1
J2T2	27,8	14,4	0	42.2
J2T3	42,2	15,6	0	57.86

Based on the table above it can be seen that the highest total aroma preference is J1T3 treatment with a total score of 60%. While the lowest total preference was obtained by J2T2 treatment with a total score of 42.2%. There was no significant difference in the aroma parameters allegedly caused by the aroma of ginger juice produced strong scented both *Zingiber officinale var officinarum* and *Zingiber officinale var rubrum*.

That is because there are volatile oils in ginger (oil evaporate) and oleoresin (oil does not evaporate). Volatile oil is usually called essential oil is a component that gives a distinctive aroma to ginger where the essential oil content of 1-3% (Dita, 2018).

4.8 Determination of Interest Weight and Expectation Value

Table 3
The Importance Weight of Coconut Oil and Expectation Value Calculation Results

Parameter	Importance weighting
Free Fatty Acid	0.30
Water Content	0.23
Peroxide Number	0.21
Color	0.11
Aroma	0.09
Yield	0.06

Treatment	Expectation Value
J1T1	7.10
J1T2	5.88
J1T3	5.39
J2T1	9.24
J2T2	4.86
J2T3	1.42

Expectation value is one of the components used to determine the best alternative treatment to be chosen. where the results of calculating the expected value for alternative selection can be seen in Table 3

8 Conclusion, Implication and Limitation

5.1. Conclusion

Based on the results of research that has been done, it can be concluded as follows: Treatment of J2T1 (use of Zingiber officinale var rubrum filtrate and 36 hours incubation time) was selected treatment with a total expected value of 9.24. This treatment has an FFA content of 0.19%, a moisture content of 0.24%, a peroxide number of 0.516 meq / 1000 grams, a yield of 29.80% and has a percentage of total preference on color 98.8% and aroma of 51.1%.

5.2. Implication and Limitation

Based on the conclusion, the following things can be suggested:

1. Further research needs to be done with other factors that affect the quality of coconut oil products that are processed by enzymatic methods.
2. Further research is needed regarding the levels of the protease enzyme contained in *Zingiber officinale var officinarum* and *Zingiber officinale var rubrum*.
3. Further research is needed to reduce the number of saponification in coconut oil.
4. Further research is needed to eliminate the aroma of ginger in coconut oil using

absorbents.

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