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Papain-induced enzyme source to the quality of virgin coconut oil

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Abstract
Virgin Coconut Oil (VCO) is made from old coconut raw material (*Cocos nucifera* L.) with the addition of papaya latex (*Carica papaya* L.). Water content and free fatty acid levels are important aspects that need to be known in pure coconut oil products so they are known for their quality. This study aims to determine the percentage of papaya latex as an optimal source of papain enzymes against the separation of cream components and coconut milk skim. Some parameters other than oil yield, including water content, free fatty acid levels, organoleptic color and aroma tests were analyzed based on the established quality standards. The treatment given in the manufacture of virgin coconut oil is the addition of papaya latex with a concentration of 5%, 10%, and 15%. The results showed that the highest oil yield was 29.8%; lowest water content of 0.12%, and the lowest free fatty acids 0.16%. Organoleptic tests showed that the ones that were not good in terms of color and aroma were samples with a percentage of papaya sap extract 15%. Based on the overall parameters, it can be concluded that in the manufacture of enzymatic virgin coconut oil products the best is a sample with a percentage of 10% papaya latex.

Keywords: papain, enzyme, virgin coconut oil

1. Introduction
Indonesia as the largest archipelagic country has the largest coconut plantation in the world with an area of 3,654,478 Ha, equivalent to 30% of the total area of coconut plantations in the world (Palungkun, 2001; Anwar & Salima, 2016) [8, 1]. Coconut (*Cocos nucifera*) has a very strategic role for the people of Indonesia. The strategic role was seen from the total area of coconut plantations in Indonesia which reached 3.7212 million hectares (31.4%) and was the largest area of coconut plantations in the world. Indonesian coconut production per year ranks second in the world, amounting to 12.915 billion items (24.4% of world production) (Syah, 2005) [13].
The part of the coconut tree that has many benefits is the fruit. Since centuries ago, coconut fruit has been used as the main food. In Indonesian society, coconut is difficult to separate from daily life, both in rural and urban areas (Sutarmi & Rozaline, 2006) [12].
One diversified product from coconut fruit is pure coconut oil or VCO (Tanasale, 2013) [14]. Virgin coconut oil (VCO) is a form of processed coconut meat that many people have recently produced. In some areas, VCO is better known as virgin oil, virgin oil or virgin coconut oil. VCO is used as a medicine and is believed to cure various diseases (Setiaji & Surip, 2006) [10].
Virgin Coconut Oil (VCO) is pure coconut oil produced from fresh old, & Sangi, 2014) [6].
Virgin Coconut Oil besides having a lot of uses in terms of processing can be processed in a simple and technically easy way so that people from any circles can do it. In addition, the processing of Virgin Coconut Oil is carried out enzymatically with materials that are easily obtained so as to reduce energy use and costs. The use of enzymes in the processing of oil is to break down proteins that bind to oil and carbohydrates so that the oil can be separated properly and increase the yield of the oil extracted from coconut milk cream.
The enzymatic processing of Virgin Coconut Oil can be carried out with the help of papaya latex based on the principle of protein breakdown which is a protective layer of fat globules which will be destroyed by the enzyme papain which is classified as protein breaking enzyme (proteolytic). Based on this principle, this auxiliary material will facilitate the separation of coconut milk into cream and skim in the process of oil formation.
Papaya plants (*Carica Papaya* L) contain white sap, feels bitter, can dissolve in water and are found in many parts of young fruit, limbs and stems when incised (Rukmana, 1995) [9]. Papaya sap as a raw material in the manufacture of papain enzyme is one form of increased utilization of papaya fruit which has not been utilized properly. So the author views the need to do research on the induction of papain as a source of enzymes on the quality of virgin coconut oil.

2. Methods
This research is an experimental study which aims to determine the percentage of papaya sap as an optimal source of papain enzyme against the separation of cream components and coconut milk schemes. Some parameters other than oil yield, including water content, free fatty acid levels, organoleptic color and aroma tests were analyzed based on the established quality standards. This research was conducted at the Laboratory of Microbiology and Chemical Laboratory Analysis of the Faculty of Pharmacy, University of Muslim Indonesia.

2.1 Tools and materials

The tools used in this study were basins, stirring rods, packaging bottles, burettes, porcelain cups, glass funnels, Erlenmeyer, goblets, measuring cups, calico cloths, filter paper, ovens, electric graters, water baths, drop pipettes, volume pipettes stainless steel blades, thermometers, analytic scales and rough scales. The ingredients used were coconut in old (*Cocos nucifera*), papaya latex, 0.1 N NaOH, phenolphthalein indicator, 95% neutral alcohol, and aquadest.

2.2 Coconut oil processing procedure

4600 g of old coconut fruit meat from 10 grains of coconut is shredded with the electric grater. Grated coconut is then squeezed with the calico cloth until 2000 ml of pure coconut milk is obtained. Pure coconut milk is divided into 4 parts each 500 ml, then put into a glass or Erlenmeyer. Added papaya latex to coconut milk, 5%, 10%, 15% and as a control (-) without the addition of papaya sap. The mixture of coconut milk and papaya latex was allowed to stand for 24 hours at room temperature (28^0C). The cream is taken and then placed in a goblet or Erlenmeyer, then heated on a water bath at 70 ^{o}C while continuing to stir for 15 minutes. Then it is cooled at room temperature (28^0C). Filtering is done using filter paper to obtain pure coconut oil. Pure coconut oil is then packed into sterilized oil bottles at 160^0 C for 2 hours.

2.3 Analysis

VCO analysis used in this study includes organoleptic tests (Soekarto, 1985) including a color test and aroma test, from pure coconut oil produced. Oil yield (Ketaren, 1986) [3, 4] the coconut fruit will be produced into coconut milk to produce mL of coconut milk which will be used for processing coconut oil. Analysis of soil moisture content (Apriyantono *et al.*, 1989) [2] and analysis of free fatty acid or FFA levels using 0.1 N NaOH using phenolphthalein indicator to the right pink color.

3. Finding

The results of measuring the quality of virgin coconut oil are as follows.

Table 1: Results of the organoleptic test of pure coconut oil obtained from coconut milk with the addition of various percentages of papaya sap

Perlakuan Concentration (%)	Color	smell
(-)	Clear	Normal
5	Clear	Normal
10	Clear	Normal
15	A little dark	A bit rancid

According to the Asian and Pacific Coconut Community (APCC) standard Normal and Clear Color

Table 2: Results of measurement of a yield of pure coconut oil obtained from coconut milk with the addition of various percentages of papaya sap

Treatment Concentration (%)	Results (%)
(-)	14.4
5	25.6
10	28.8
15	29.8

Table 3: Measurement Results from the Water content of pure coconut oil obtained from coconut milk with the addition of various percentages of papaya sap

Treatment Concentration (%)	Results (%)
(-)	0.12
5	0.13
10	0.12
15	0.18

According to the Asian and Pacific Coconut Community (APCC) standards a maximum of 0.5%

Table 4: Results of Measurement of free fatty acids from virgin coconut oil obtained from coconut milk with the addition of various percentages of papaya sap

Treatment Concentration (%)	Results (%)
(-)	0,19
5	0,16
10	0,16
15	0,22

According to the Asian and Pacific Coconut Community (APCC) standards a maximum of 0.5%

4. Discusión

Based on the research conducted on pure coconut oil (VCO), the visual analysis data obtained were coconut oil with the addition of 15% papaya latex, the oil color was rather dark, while 10%, 5%, and control (-) oil color were clear.

The greater the percentage of papaya latex dissolved in coconut milk, the more effective the performance of enzymes in hydrolyzing proteins in coconut milk to convert it into amino acids which then reacts with reducing sugar in the coconut milk itself to produce a dark color in coconut milk (browning reaction). This is supported by the opinion of Shah (2005) that the reaction between carbonyl from carbohydrates and amino acids from proteins will cause a browning reaction.

Based on the results of organoleptic test, pure coconut oil obtained a normal aroma from the three pure oils produced, namely from the addition of 10% papaya latex; 5% and Control (-) with a distinctive aroma of coconut oil and less than the addition of 15% papaya sap percentage with a slightly rancid aroma. This can be caused by oil with the addition of a percentage of 15% papaya latex extract there is a number of water with a high enough level and there is contamination from the outside air which will accelerate the occurrence of damage, especially in terms of aroma that produces a rather rancid odor. According to Setiadji and Surip, (2006) [10] that rancidity can be caused by the hydrolysis process, because there is a certain amount of water and oxidative rancidity due to the influence of oxygen. The main difference between VCO and commercial coconut oil is the smell and taste of oil (taste). VCO smells good and tastes typical of coconut oil while commercial coconut does not have the typical characteristics due to the purification process (Sutarmi and Rozaline, 2006) [12].

The yield of yields in pure oil obtained from various percentages of the addition of papaya latex is 5% as much as

25.6%; 10% as much as 28.8%; and 15% as much as 29.8%. While control (-) was 14.4%. From the results obtained the higher the concentration of papaya sap, the higher yield will be. This can be caused by the influence of the addition of papaya sap into coconut milk in the process of processing pure coconut oil, where the enzyme papain is a proteolytic enzyme that is breaking down protein (Muhidin, 1999) [7], so that the oil in coconut milk can separate well and produce high yields.

The highest water content of pure coconut oil was obtained from the addition of 15% papaya latex as much as 0.18% and the lowest was from the addition of 10% papaya latex and control (-) as much as 0.12%, while the addition of 5% papaya latex was 0.13 %. Hydrolytic rancidity is caused because there is a certain amount of water outside the tolerance threshold contained in the oil, thus accelerating the occurrence of hydrolytic damage. In the opinion of Ketaren (1986) [3, 4], the hydrolysis record that can cause damage to oil or fat occurs because there is a certain amount of water in the oil or fat. This reaction will result in the constancy of hydrolysis which results in a rancid odor in the oil. According to Wong and Hartina (2014) [15], the water content of oil is one of the parameters that affect the shelf life. The higher the water content, it will cause the oxidation process and thus produce rancidity. High free fatty acids in coconut oil have a higher moisture content.

The content of saturated fatty acids pure coconut oil is dominated by lauric acid (44-52%) which is medium chain triglyceride (MCT). Lauric acid is what makes pure coconut oil unique because most oils do not contain MCT. This uniqueness makes virgin coconut oil different from all other vegetable oils and is able to increase health for the body. MCT in the body is broken down and is predominantly used to produce energy and is rarely stored as fat that grows or accumulates in the arteries. Therefore, fatty acids from virgin coconut oil produce energy, not fat (Kuncoro, 2006) [15].

The heating is intended to reduce the water content in the oil. This is supported by the opinion of Shah (2005), that heating is a preliminary sterilization, besides that it is also to evaporate water and increase oil dilution (fluidity).

Determination of acid numbers obtained from the results of quality analysis of virgin coconut oil (VCO) is from the addition of 15% papaya latex as much as 0.22%, and the addition of papaya latex is 10% and 5% respectively by 0.16%. While those obtained from control (-) were 0.19%. This free fatty acid component is formed from the result of triglyceride hydrolysis which produces glycerol and free fatty acids.

One identification of the low quality of coconut oil is the high level of free fatty acids. This shows that the pure coconut oil produced has good quality and meets the requirements of quality standards for Virgin Coconut Oil issued by APCC which is a maximum of 0.5%.

5. Conclusion

Based on the results of research and discussion, it can be concluded that the overall parameters in the manufacture of enzymatic Virgin coconut oil are the best sample with a percentage of 10% papaya latex which has a normal odor and clear color during organoleptic testing.

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