Formulation of Virgin Coconut Oil (VCO) from Centrifugation and Spontaneous Fermentation Processes with Rice Bran Oil (RBO) for a Food Supplement

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ABSTRACT
Coconut (Cocos nucifera) is a plant belonging to the Arecaceae family with a myriad of uses. Virgin coconut oil (VCO) is one of the products that can be derived from this plant. The free fatty acid content, especially lauric acid, determines the quality of VCO. There are several methods of VCO production, depending on the raw material treatments and purification/separation processes. The common methods used are centrifugation and fermentation to produce VCO that meets the Standard Nasional Indonesia (SNI). Those methods yield lauric acid contents at 45.1 – 53.2% and lauric acid are known to have antibacterial and antiviral potentials. This study aimed to produce VCO with lauric acid content that met SNI standards for food supplements to increase immunity by formulating it with Rice bran oil (RBO). RBO is known to contain vitamins, antioxidants, and fatty acids, such as linoleic acid, that are needed to boost the immune system and nutrient absorption. The coconuts used were fresh ripe fruits and prepared with the wet processing procedure. The research method included comparing centrifugation and spontaneous fermentation processes, with the time of precipitation/fermentation as the independent variable. The best yield of VCO was used in combination with RBO to generate a nutritious food supplement. The centrifugation and spontaneous fermentation methods produced the highest VCO yields of 39% and 33% respectively after 24 hours of precipitation. GC-MS (Gas chromatography-mass spectrometry) analyses were employed to determine the lauric acid contents in the resulting VCO. The results showed that the lauric acid contents were 52.1% for the centrifugation and 52.3% for spontaneous fermentation. The food supplement formulation is consisting of 95% VCO and 5% RBO, and from that 100g formulation is contained 46.519 grams lauric acid and 2.431 grams.

Keywords: *Antivirus, Lauric Acid, Linoleic Acid, Rice Bran Oil, Virgin Coconut Oil.*

1. INTRODUCTION

Coconut (Cocos nucifera) is one of the plants belonging to the Arecaceae family and widely distributed throughout Indonesia. Considered as one of the primary commodity crops, Indonesia is the largest producer of coconuts in the world. Coconut oil is a product that can be derived from this plant, and virgin coconut oil (VCO) has a high content of lauric acid and thus the potential to become as a source of healthy food. Lauric acid in VCO can be converted into monolaurin, which has antimicrobial properties and can boost the immune system in humans.

VCO is generated from fresh coconuts and extracted with or without heating. Wong and Hartina [11] conducted a study on VCO extraction at various centrifugation speeds, temperatures, and time intervals. They reported a yield of 13.53% at 12,000 rpm for 120 minutes and the highest yield of 13.80% at centrifugation temperature of 40ºC. Hapsari and Welasih [7] recorded lauric acid content of 36.67% from VCO after

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centrifugation at 1000 rpm for 90 minutes and incubation period of eight hours.

This study aimed to determine the best method to produce VCO containing lauric acid that would meet SNI requirements. Additionally, another objective was to determine the effectiveness of VCO in combination with rice bran oil, which contains linoleic acid, as a food supplement with antibacterial and antiviral properties.

Rice bran is a by-product of rice processing. Its use is currently still very limited, usually only used as animal feed. Rice bran contains various important compounds and nutrients, which can be used as food additives and non-food ingredients. Important content in rice bran is carbohydrate protein, crude fiber, ash, lipids including the content of oleic acid, linoleic acid, oil (Rice bran oil = RBO) and essential oils. Due to the presence of phytochemicals, such as the phenolic group, rice bran has various important benefits, including as an additive for food and cosmetics, namely as an antioxidant.

2. MATERIALS AND METHOD

2.1. Materials

Fresh coconut milk was added with distilled water with ratio 1:1. The mixture was then left to stand for 3 hours at room temperature. In the first stage cream is separated by the action of gravitational force resulting in two phases, the top phase with the creamy layer and the down phase with aqueous layer. The rice bran oil that is used is the result of the extraction of rice bran using the screw press method.

2.2. Methods

2.2.1. VCO Synthesis

The coconut milk result was divided into two that next will process either use centrifugation or spontaneous fermentation method.

The centrifugation method followed the protocol described in the study conducted by Hapsari and Welasih [7], which coconut milk was centrifuged at 1000 rpm for 60 minutes. Samples were further deposited at various times of 0, 8, 12, 16, 20, or 24 hours. Each sample was filtered three times following the precipitation and produced VCO, water, and solid byproduct, which is called blondo in Indonesian. These steps are described in Figure 1.

The second method of VCO production was spontaneous fermentation. Samples of coconut milk cream were placed in test tubes, incubated for 0, 8, 12, 16, 20, or 24 hours, and filtered. The steps in this method are described in Figure 2. The VCO preparations produced from the two methods of extraction were analyzed for yields and lauric acid contents using GC-MS spectrometer. The lauric acid contents in the VCO preparations determined the formulation of VCO-RBO mixture, and the ratio was decided at 95% VCO to 5% RBO. The steps in this method are described in Figure 3.

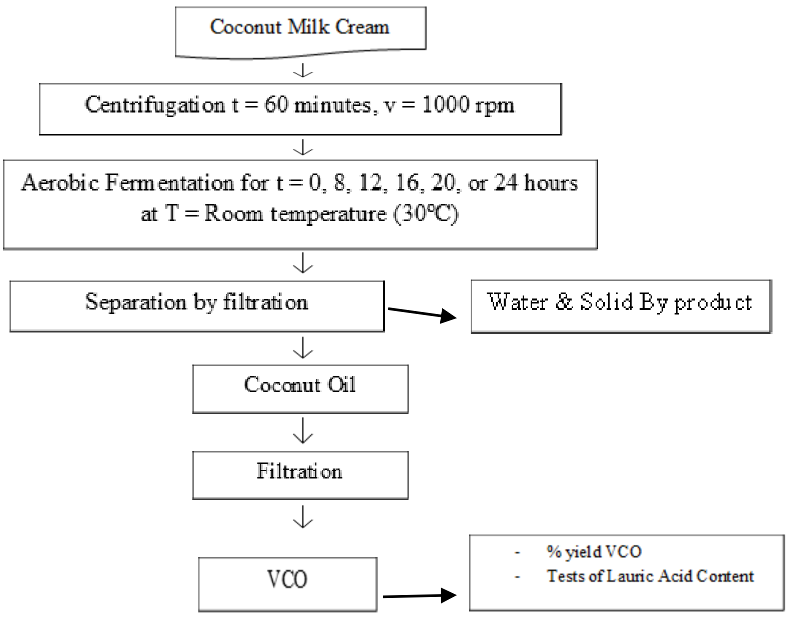

Figure 1 The flowchart for VCO production with Centrifugation method

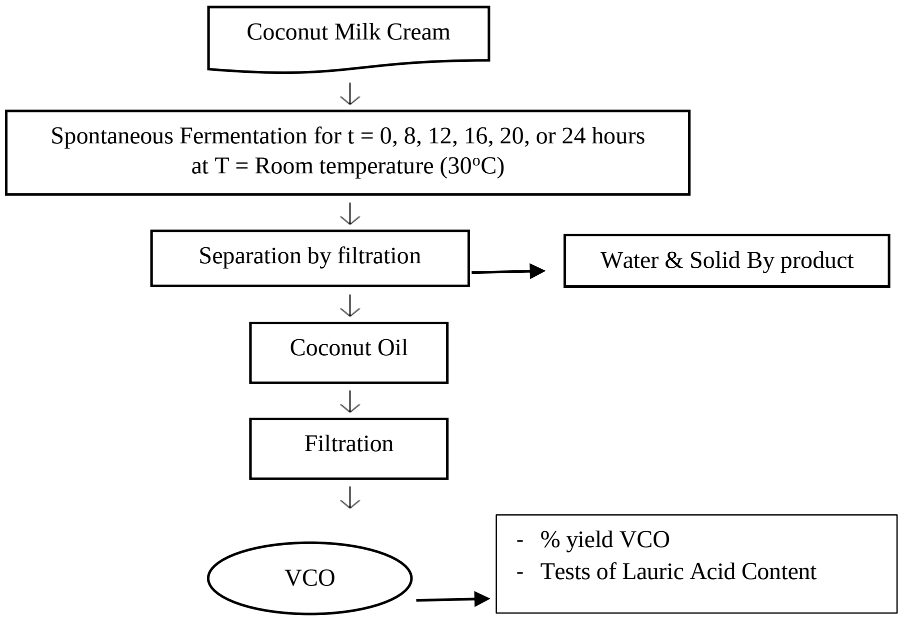

Figure 2 The flowchart for VCO production with Spontaneous Fermentation method

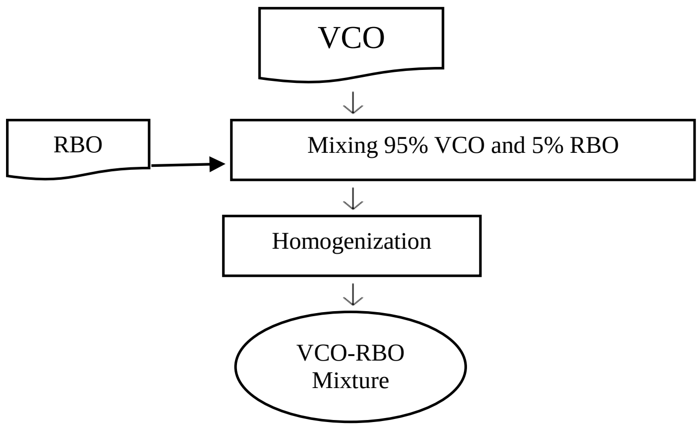

Figure 3 The flowchart for the formulation of VCO-RBO mixture

The VCO-RBO mixture was placed in capsule shells, size 0, to determine the difference of product packaging that would be preferred by the respondent in general consumption. The Lauric acid and linoleic acid tested before packaging into capsules.

2.3. Method of Analysis

2.3.1. Organoleptic Tests

The organoleptic test is an analytical method consisting of observing respondents using the senses of smell, sight and taste to evaluate the quality of a product. This test was conducted on 75 respondents using two sample models.

2.3.2. Lauric Acid Content Analyses

The lauric acid content was determined using gas chromatography (GC).

2.3.3. Product Presentation Tests

The VCO-RBO mixture that is being tested for consumption is packaged in two forms, liquid and capsule. Data collection was carried out to determine the presentation of the products preferred by respondents.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Centrifugation Method

The centrifugation process on colloidal mixture obtained from the coconut milk produced three layers, which were cream, water, and pellet. Following centrifugation, samples underwent a precipitation process for 24 hours at room temperature and were analyzed at predetermined intervals. Figure 4 exhibits the condition of samples at eight hours after centrifugation.

Figure 4 Coconut milk samples after precipitation for eight hours

Following centrifugation, samples underwent a precipitation process for 24 hours at room temperature and were analyzed at predetermined intervals. Figure 4 exhibits the condition of samples at eight hours after centrifugation.

3.1.2. Spontaneous Fermentation

The colloidal mixture squeezed from the coconut milk added with a small amount of water was placed into test tubes and allowed to precipitate/spontaneously ferment for 24 hours at room temperature as presented at Figure 5. The samples were analyzed at predetermined intervals.

Figure 5 Coconut milk samples at the beginning of a spontaneous fermentation process

In the first hour of this process, there are no significant changes observed in the visual appearance of the samples. Figure 6 shows the condition of samples at hours 8 of the spontaneous fermentation process.

Figure 6 Coconut milk samples after eight hours of the spontaneous fermentation process

The highest yields were generated at 24 hours of precipitation/fermentation in both centrifugation and spontaneous fermentation methods as Figure 7.

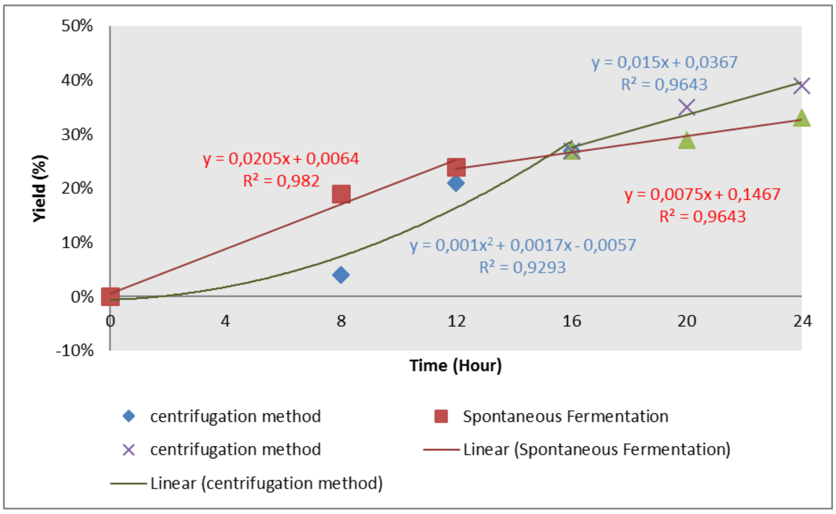

Figure 7 The per cent yield of VCO from the centrifugation and spontaneous fermentation process

3.2. Product Analyses

3.2.1. Organoleptic Tests

The organoleptic tests involved 75 respondents who each were given two samples to evaluate. They were to report the quality of the samples based on odour, taste, and opacity. The results are explained in Table 1.

3.2.2. Lauric Acid Content

GC analysis on VCO extracted by centrifugation and spontaneous fermentation method yielded lauric acid levels of 52.1% and 52.3%, respectively. This value fulfills the SNI requirements of 45.1 - 53.2% as presented at Figure 8.

Table 1. Organoleptic tests on VCO

Observation	VCO	
	Centrifugation	Spontaneous Fermentation
Odour	Fresh coconut scent Not rancid	Fresh coconut scent Not rancid
Taste	Unique Coconut Taste	Unique Coconut Taste
Opacity	Clear, Transparent	Clear, Transparent

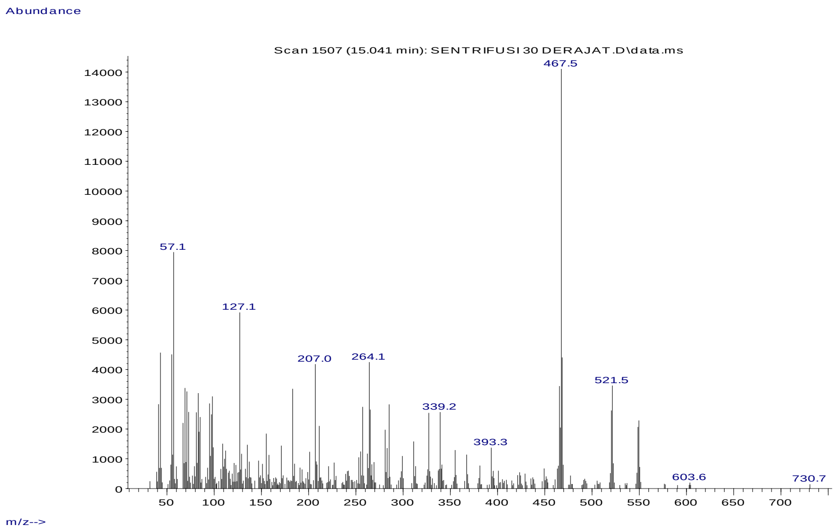

Figure 8 GC-MS of lauric acid content in VCO extracted with centrifugation method and 24-hour precipitation time

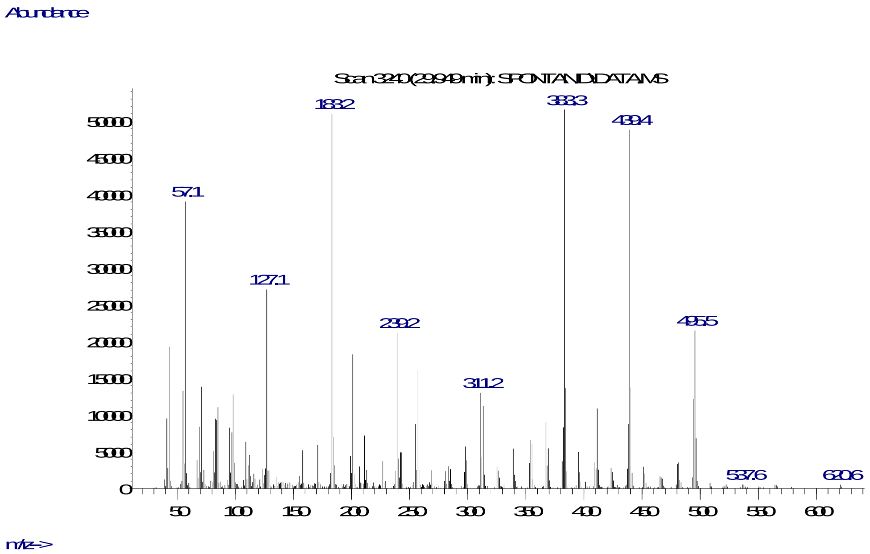

Figure 9 GC-MS of lauric acid content in VCO extracted with spontaneous fermentation with 24-hour precipitation time

3.2.3. Organoleptic Foods Supplement of VCO-RBO Formulations

The VCO-RBO formulation was tested for respondent consumption and presented as liquid or packaged in capsules, size (0). The results showed that the capsule version was preferred twice (66.2%) as much as the liquid form as presented at Figure 10.

3.2.4. Lauric Acid Content in the VCO-RBO (95:5) Formulation in Capsule

RBO was added to VCO at the ratio of 95:5 (%) to complete the food supplement formulation and packaged in capsules, size 0. The capsule version was used not only for product presentation but also for marking the dosage. GC-MS analyses of this mixture in the amount for encap-

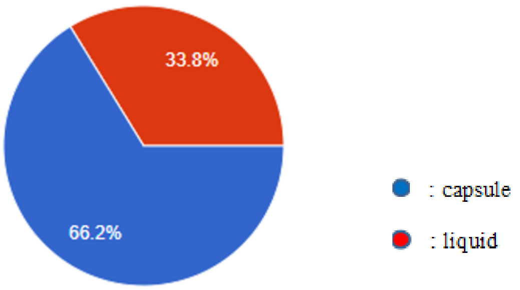

Figure 10. The pie chart on the public's preference for product packaging of VCO-RBO formulation as a food supplement

sulation determined that linoleic acid content was at 2431 mg/100g and lauric acid content was at 46519 mg/100g as presented at table 2. As previously mentioned, the lauric acid content in this formulation met the SNI requirements. Whereas the linoleic acid content also fell within the Health Ministry recommended daily allowance values of 16-17 grams/day of adult males and 11-12 grams/day for adult females.

Table 2. The Lauric acid and Linoleic acid contents in the VCO-RBO formulation

No	Parameter	Result (mg/100g)
1	C18:2 (Linoleic Acid)	1.103,8
2	C12:0 (Lauric Acid)	48.874,5

4. CONCLUSION

The time of precipitation in both centrifugation and the spontaneous fermentation methods to produce VCO significantly affected per cent yield at 24 hours show a higher yield. The two methods investigated affected the lauric acid contents of VCO produced. Centrifugation and spontaneous fermentation generated VCO with lauric acid contents of 52.1% and 52.3% respectively, which met the SNI requirements of 45.1 – 53.2 %. 4.The addition of RBO showed to improve the nutrient content in food supplement formulation. The linoleic acid content met the Government's standard on the recommended dietary allowance. There was an interest in VCO-RBO formulation as a food supplement. Capsule form was preferred by the public to liquid form by the factor of two to one for the packaging of VCO-RBO supplement.

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