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The Effect of Mixing Red Coconut and Green Coconut on The Manufacture of VCO Using the Centrifugation Method

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Abstract

Virgin coconut oil (VCO) can be made from several types of coconuts by using several techniques that potentially result ini clear colour, distinct coconut smell, and long shelf life. In this study, centrifugation method was used in the manufacture of VCO by using green coconuts and red coconuts with a ratio of 1:1 and 2:1. This study aims to determine the ratio of the best raw materials and determine the % yield. This study uses factorial design and a quicker method for calculating the effect of the process variable with eight runs (experimental). The most influential variable was the centrifugation time, where the optimum yield was 35 minutes, the centrifugation speed was 800 rpm, and the ratio of green coconut and red coconut was 4:3. yielded 56.8% yield. It can be concluded that the best way to produce VCO with a high yield is to use a centrifugation method with a ratio of green to red coconuts of 4:3, a centrifugation time of 35 minutes, and a centrifugation speed of 800 rpm.

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Introduction

The horticultural industry, which is the core of international trade in Indonesia, has an abundant supply of raw materials thanks to the country's agricultural sector. Coconut is one of the important commodities produced by the Indonesian horticultural subsector. Indonesia is one of the world's major producers of coconut, accounting for about a quarter of global production. There were an estimated 3.76 million hectares of coconut land in Indonesia in 2000, yielding 17.3 to 18.7 million tons within the last 10 years. This land produces a total of up to 14 billion coconuts and provides a source of income for 2.5 million farmers (Setiawan, 2002).

Since the development of the palm oil production and manufacturing business, the VCO production and manufacturing industry has declined drastically and is concerning. There are several reasons why the VCO production and manufacturing industry has declined drastically for some reason such as oversupply, competition from other oils, lack of government support, high production cost and low profit margin. Coconut offers many benefits, and all parts of coconut can be processed, including the meat, which can be used to produce coconut milk, both liquid and powdered. This is unfortunate since VCO contains medium-chain fatty acids in the form of lauric acid, which acts as a direct source of energy and may have anti-viral properties, among other benefits of coconut (Novarianto, 2007).

According to the Directorate General of Plantations, Indonesia was able to produce around 2,811,954 tons of coconut fruit in 2020. With relatively significant coconut production, it would be a shame if its utilization is not maximized to the maximum. The coconut tree is sometimes referred to as the "tree of life" because it provides many advantages for human existence around the world. Almost every component of the coconut plant has beneficial properties for humans. It is possible to make a large number of items from coconut palms.

VCO has a high concentration of fatty acids, and VCO is considered to offer several beneficial properties for maintaining human health. The fatty acids in VCO are medium-chain fatty acids (MCFA), which help control weight and increase energy levels by accelerating metabolism (Setiaji, 2005). Lauric acid, which makes up 50.33 percent of virgin coconut oil, is the most common component, according to Cahyana (2005). The formula also contains caproic acid (14.23%), capric acid (10.15%), myristic acid (12.91%), and palmitic acid (4.92%).

Produce high-quality VCO using various techniques; however, one of the most effective approaches is to avoid VCO heating, since heating can reduce the vital materials included in VCO. Heat should be used as little as possible, if not completely avoided, to produce high-quality VCO. The stirring technique is a way to produce VCO that does not require the use of a heating process. It can be done by using low heat setting, constant stirring, regular temperature checking. After some time, oil, water, and protein will separate due to the centrifugal force generated by the resulting movement and certain circulation patterns. An uneven circulation pattern is created in the stirred liquid as a result of the turning of the impeller. At the time of stirring, several factors affect the amount of VCO produced. This includes the type of coconut used, the stirring speed, the number of baffles, and the type of impeller used (Purwanto, 2006). Based on these problems, there needs to be a scientific study on the Effect of Rotation Speed and Centrifugation Time on making VCO with Coconut Mixture.

Materials and methods

Materials

This study was conducted in December 2021 - January 2021 at the Laboratory of Vocational School, Diponegoro University, Semarang.

The ingredients used in this study were green coconut, red coconut, aquadest, KOH, PP indicators, and ethanol. The tools used in this study were digital balance sheets, plastic containers, plastic, filter cloth, filter paper, measuring cups, clamps & statives, drip pipettes, burettes, glass stirrers, stopwatches, cuvettes, test tube racks, Erlenmeyer, centrifuges, ovens, and PET bottles.

VCO Manufacturing Method

Preparation of coconut milk

To make coconut milk, it takes a ratio of 1:1 between green coconut and red coconut and 2:1 between green coconut and red coconut. Coconut water can be used as a raw material for making coconut milk after peeling and splitting. Using a grated machine, coconut meat is taken from the shell and grated. When making coconut milk, squeeze the grated coconut that water has been added to the container. The ratio of water to coconut is 1:1 where 660 grams of coconut and 330 ml of water are squeezed 2 times. The water used has been treated hygienically to minimize microbial contamination.

Separation of skim and water

Coconut milk containers are made by pouring coconut milk into transparent plastic and tightly closed. After that, let the coconut milk stand at room temperature for approximately two hours. Coconut milk will be separated into 3 parts, namely thick coconut milk (cream) at the top, skim coconut milk (milk that does not include cream) is found in the middle, and water is found at the bottom. Separate the cream gently using a spoon before transferring it to a new container.

VCO Separation Process with Centrifugation Technique

The tube is filled with coconut milk and then put into a centrifuge. The centrifuge is then sent, at us of rotational speeds to 700 or 900 revolutions per 60 seconds and timers to 20 or 40 minutes. The centrifuge then begins. Turn off the centrifuge and let it cool for a few minutes. Take a tube with VCO and a coconut milk head inside. In the tube, the coconut milk head will release as much oil as possible, so that two layers are formed, namely the coconut milk head and coconut oil. Then filter the obtained VCO using filter paper. This screening procedure is designed to isolate VCO from vegetable proteins (VCO) to obtain pure VCO.

Harvesting and Packaging

Separate VCO and oil (oil) or use VCO that is not put in oil (oil). The oil obtained is then filtered through a cotton sieve and finally through filter paper. The oil extracted from this second filter is now suitable for consumption and packaging. Bottles are made of polyethylene terephthalate (PET).

Results and Discussion

Yield of VCO

Run	Rotational Speed (rpm)	Lap Time (Minutes)	Comparison of raw materials	Yield (%)
1	700	20	3	47.5
2	900	20	3	50.0
3	700	40	3	50.8
4	900	40	3	53.0
5	700	20	7	50.8
6	900	20	7	52.5
7	700	40	7	55.0
8	900	40	7	56.6

Table 1 shows that the weight of the oil and the yield of the oil produced have values according to the markings of the variable level of the rotation speed process, the use of time variables at the lower level of 700 rpm produces weight and oil yields that are less than the upper level of 900 rpm, these variables refer to research conducted by Yadi, et al. (2018) which obtained optimal yields at a centrifugation speed of 800 rpm and a lap time of 30 minutes. Furthermore, optimization of yield will be carried out.

Optimization of VCO Yield

From the variance analysis that has been carried out, the process variables that are based on the research process of pure coconut oil extraction or VCO are rotation time, so that for this optimization process the variables v (rotation speed) and P (comparison of raw materials) become fixed variables and variable t (rotation time) become variables change. The results of the optimization that has been carried out can be seen in Table 2.

Table 2. VCO Yield in Optimization Process

Lap Time (minutes)	Rotational Speed (rpm)	Comparison of raw materials	Yield (%)
20	800	4:3	52.4
25	800	4:3	52.9
30	800	4:3	54.2
35	800	4:3	56.8
40	800	4:3	55.9

Based on the resulting oil yield as presented in Table 2 and the graph in Figure 1, the rotation time (t) of 35 minutes is the best result with a yield of 56.8% with other optimum conditions, namely a rotation speed of 800 rpm and a raw material ratio of 4: 3.

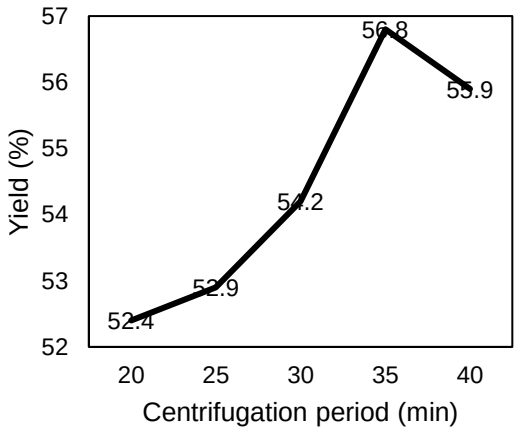

Figure 1. Optimization Results

The length of the rotation time will affect the amount of oil produced, the longer the separation process, the more oil droplets separate from the emulsion, and generally the longer the rotation time, the more optimal the oil yield obtained. However, this only lasts for a certain time, because after the oil in the sample has separated from the emulsion, the next process does not affect the resulting oil and is better stopped as the yield in the 5th experiment presented in Table 2 and Figure 1 has decreased. When compared to research conducted by Fathur et al. (2018) the yield of oil produced 68.75% at a stirring speed of 6000 rpm shows that the stirring time has a significant effect on the yield of the oil produced.

Analyses of VCO

The analysis tested included amendment tests, fatty acid content, and water content accompanied by SNI from VCO, the results of previous research tests, and VCO produced by MSME as a comparison.

Levels of Free Fatty Acids

The results of observations of testing free fatty acids in virgin coconut oil can be seen in Table 3 with oil from previous studies, MSME production oil, and cooking oil SNI as a comparison. The number of acids is a measure of the number of free fatty acids contained in an oil sample. Fatty acids are produced through a hydrolysis reaction that can be caused by a certain amount of water, enzymes, or the activity of microorganisms. The higher the moisture content in the oil, the more likely the fatty acid content is also high. All enzymes belonging to the lipase group can hydrolyse fats, but these enzymes are inactivated by heat. The free fatty acids produced by the hydrolysis process can affect the flavour of the oil. When viewed in table 3 m, the results of this study have a higher acid number of 0.2% when compared to 0.01% of MSME production oil and 0.19% of the oil from the previous study, which can be caused by different operating conditions. In MSME production oil, the acid number of 0.01 is not so high compared to the results of this study and previous studies because in the production of MSME the manufacturing process did not involve creating an acidic emulsion environment in coconut milk by binding lipids. The results of this study have met the SNI of virgin coconut oil, which is a maximum of 0.2%.

Table 3. Free Fatty Acid of VCO

Testing	Research Oil	MSME Production Oil	Previous Research Oils	SNI Fried Oil
Levels of Free Fatty Acids	0.2	0.01	0.19	Max 0.2

Water Content

The results of the observation of water content testing in virgin coconut oil can be seen in Table 4 with oil from previous studies, MSME production oil and cooking oil SNI as a comparison.

Table 4. Moisture Content

Testing	Research Oil	MSME Production Oil	Previous Research Oils	SNI Fried Oil
Water content (%)	0.18	0.08	0.195	Max 0.2

The results of observations of water content testing in virgin coconut oil or VCO obtained equipped with virgin coconut oil from the results of previous studies, pure coconut oil produced by MSME and SNI virgin coconut oil as a comparison of water content in VCO has an important role because it will affect the shelf life of the VCO itself, the greater the water content in the oil, then the oil will be more susceptible to damage. Triglycerides contained in fats will be hydrolysed and become glycerol and fatty acids due to the presence of acids, bases, and enzymes. The hydrolysis process easily occurs in materials with large moisture content. VCO with low water content will have a better shelf life and the quality of VCO will be better (Rachmawati, 2022). An important parameter in VCO is moisture content. The shelf life of VCO will be higher when the moisture content is low. Moisture content greatly affects the physicochemical properties of pagan products, microbiological and enzymatic changes. The high-water content in the material leads to the low durability of the material. The water content is calculated from the difference between the weight of the oil before the water in the oil is steamed and the weight of the oil after the water in the oil is steamed. Overall, the resulting VCO water content meets the requirements of the Indonesian national standard (SNI), which is a maximum of 0.2%. In

Table 4, the water content in this study was 0.18%, where the value was much higher than the water content of oil produced by MSME of 0.08% and did not differ much from the water content of the previous research oil of 0.195%, the results were still under the SNI of cooking oil, which was a maximum of 0.2%.

Conclusion

From optimization process by varying the rotation time of virgin coconut oil shows that the extraction time has a real influence on the yield of the oil produced, the longer the rotation time, the greater the yield of the oil produced. The optimum extraction time in this study was 35 minutes with a yield of 56.8% for a rotation speed of 800 rpm and a mass ratio of raw materials of 4:3. The chemical properties of the oil in this study are in the form of the free fatty acid content of 0.2% and water content of 0.18%, which means that the oil from this study is under the SNI of virgin coconut oil.

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