

## THE EFFECT OF YEAST STARTER VARIATIONS ON THE QUALITY OF VIRGIN COCONUT OIL (VCO) USING THE FERMENTATION METHOD

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### Abstract

Virgin Coconut oil (VCO) is a coconut processed product that has high benefits and economic value. One of the methods of making VCO is the fermentation method. The purpose of this study was to determine the effect of the percentage of 3 types of yeast (starter yeast tape, starter yeast bread (*Saccharomyces cerevisiae*) and tempeh yeast (*Rhizopus sp*) on the quality of VCO produced in terms of volume, viscosity, organoleptic (color, distinctive coconut odor) and chemical test (moisture content, acid number, free fatty acid, peroxide number) The manufacturing method used was the fermentation method by varying the percentage ratio of starter for each yeast by 3%, 6%, and 9%. The results showed the addition of starter percentage Yeast has an effect on the volume of VCO produced, moisture content, acid number, free fatty acids, and viscosity These results have met the quality standards according to SNI 7381: 2008 and APCC (Asian and Pacific Coconut Community).

**Keywords:** virgin coconut oil; free fatty acids; fermentation; yeast

### 1. INTRODUCTION

Pure coconut oil or better known as Virgin Coconut Oil (VCO) is one of the superior products that have not been developed in an integrated manner from the coconut industry. This VCO product has several high added values including better quality, low water content and free fatty acids, has a distinctive odor and is colorless (clear). In term of economy has a higher selling prices than copra coconut oil so VCO production study need to be developed.

Making VCO can be done by several methods including traditional methods, fermentation and enzymatic methods. The fermentation method is an easy alternative to making VCO by adding a yeast starter for the process of breaking down the coconut milk / cream emulsion to get the desired VCO [1]. Making VCO by fermentation has advantages, namely, it is easy, cheap, and produces clearer oil [2].

VCO provides health benefits including increasing human immunity to disease and accelerating the healing process, losing weight, as an antimicrobial, good for heart and blood vessel health, preventing degenerative diseases such as diabetes, liver, bone loss and cancer [3].

The purpose of the research to improve the quality of the VCO using a starter yeast tape, starter yeast bread, and starter yeast tempeh. The research objective was to determine the effect of the 3 types of yeast used for making VCO with the fermentation method, namely tape yeast, bread yeast and tempeh yeast, as well as the effect of the percentage ratio of the starter of each type of yeast on the quality of the VCO produced.

### 2. METHODS

This research is an experimental study with a randomized design by varying the percentage addition of starter concentrations of 3%, 6% and 9%, respectively. Then the fermentation process is carried out, after which the VCO produced is analyzed. This research begins with the preparation of raw materials, namely coconut fruit. Coconut fruit will be processed into coconut milk which will later be used for the process of making yeast starter and making VCO, then testing the acid number, peroxide number, organoleptic test, free fatty acids, viscosity test, water content test.

The tools used in this research are digital balance, ordinary scale, beaker, grated coconut, transparent plastic container, basin, plastic funnel, measuring flask, pipette, Erlenmeyer 250 ml, titration device, filter paper, oven, viscometer, burette. The materials used in this study were old coconut fruit, yeast tape, bread yeast, tempeh yeast, KOH, 96% alcohol, phenolphthalein, n-hexane, acetic acid, chloroform, sodium thiosulfate, and KI solution.

The research scheme is carried out as follows:

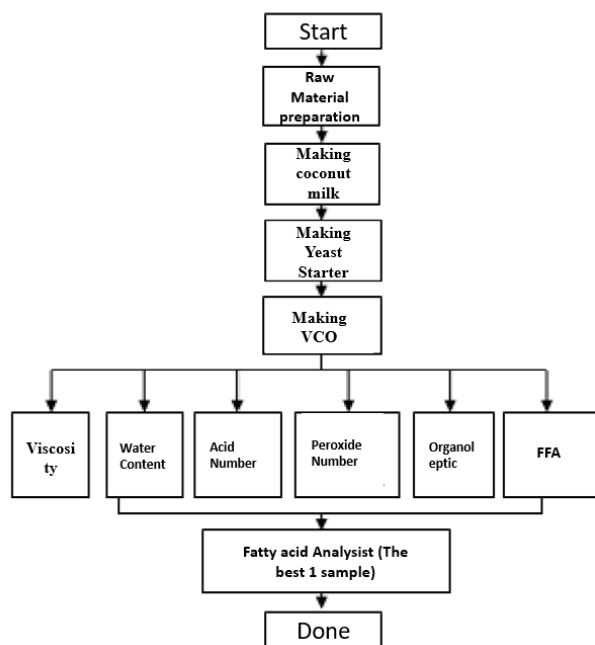


Figure 1. Research Implementation Schematic

## 2.1 Research procedure

1. Prepare dark brown coconut flesh, yeast tape, bread yeast, and tempeh yeast.
2. Peel the coconut, then take the shell apart.
3. Grate the pulp and weigh, then add water with a temperature of 50°C, a ratio of 2: 1.
4. Then squeeze and filter. Then let the coconut milk sit for 2 hours.
5. After the sediment occurs, separate the cream and skim.
6. Skim is made for yeast starter by preparing 3 containers for each starter, namely 450 ml starter added with 50 ml coconut water then adding 2 grams of yeast tape, bread yeast, and tempeh yeast.
7. Ferment for 24 Hours yeast starter.
8. Prepare 9 containers for each sample. Enter 300 ml into each container then add the starter yeast tape, bread yeast, and tempeh yeast with a percentage of 3%, 6%, 9% respectively. After that ferment for 24 hours.
9. After 24 hours the sediment occurs into 3 layers, namely the oil above, Blondo which is in the middle, and water below.
10. Filter the oil using filter paper. Then become a VCO.

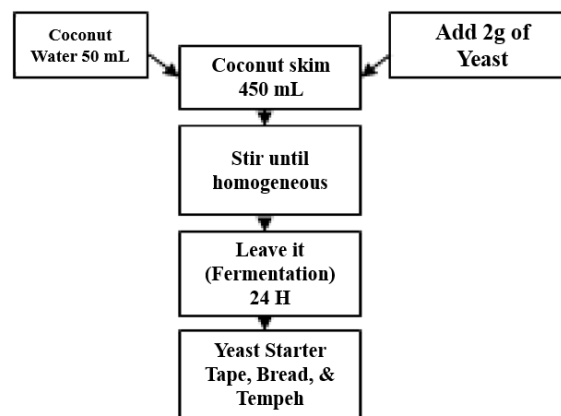


Figure 2. Flow of Yeast Starter Manufacturing Process [1]

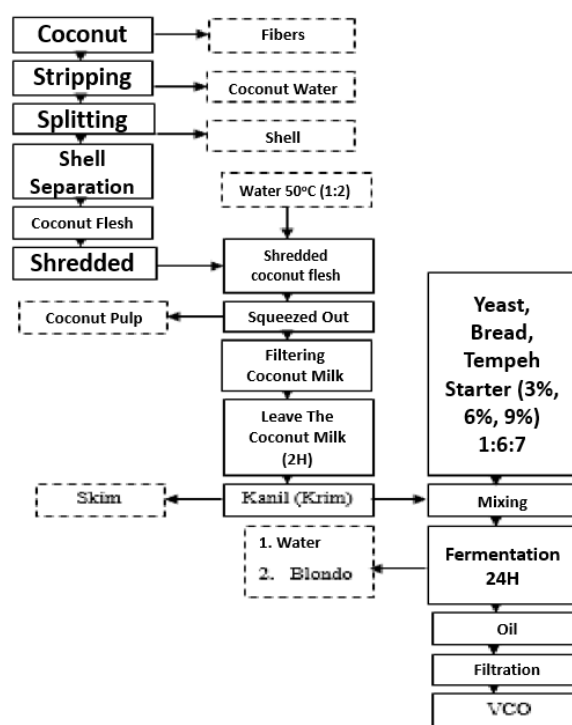


Figure 3. Flow of VCO Processing with Fermentation Method Using Tape Yeast, Bread Yeast, Tempeh Yeast [1]

## 3. RESULTS AND DISCUSSION

VCO quality requirements that are set in accordance with the Indonesian National Standard (SNI) 7381: 2008 are shown in Table 1. VCO produced by the fermentation method is tested for its characteristics, then compared with these standards to determine the quality of the VCO produced.

**Table 1 .** Resume of Product Analysis

No.	Type of test	Unit	Requirement
1	Physical appearance of oil (oil form): a. Odor b. Taste c. Color	- - -	a. Fresh coconut type, not rancid b. Normal, coconut oil type c. Colorless until pale yellow
2	%FFA (Count as lauric acid)	%	Max. 0.2%
3	Iod Number	g Iod/100 g oil	4.1 - 11
4	Saponification number	mg KOH/g oil	250 -260
5	Density	kg/m <sup>3</sup>	915.0 - 920.0

### 3.1 Organoleptic Test

Physically, VCO must have transparent and clear color properties, which indicates that there are no other materials or impurities in the VCO. Contaminants in VCO can directly influence their quality.

**Table 2.** Organoleptic Test

Variation of Adding Yeast Starter (% v / v)	VCO Organoleptic test (odor and color)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	Coconut scent & Clear	Coconut scent & Clear	Coconut scent & Clear
6	Coconut scent & Clear	Coconut scent & Clear	Coconut scent & Clear
9	Coconut scent & Clear	Coconut scent & Clear	Coconut scent & Clear

From Table 2, it can be seen that the organoleptic test, the VCO produced through the fermentation method with the addition of a yeast starter percentage of 3%, 6%, 9% and yeast variation shows has a distinctive coconut odor and colorless that meet the quality standards of VCO. The results of the VCO test produced from this study have met the requirements of SNI 7381: 2008, namely colorless to pale yellow (BSN, 2008) while based on APCC (*Asia*

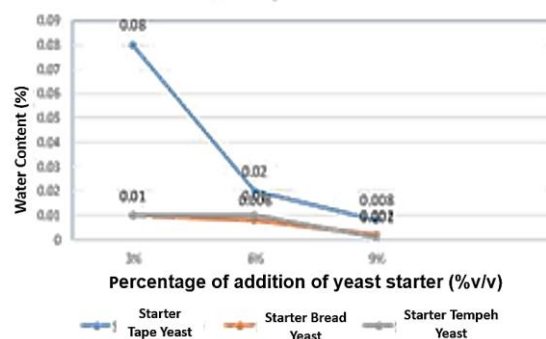
*Pacific Coconut Community*), which is clear (clear)[4]. The odor of VCO is one of the quality parameters that determine consumer acceptance of VCO. According to the requirements of SNI 7381: 2008, the odor of VCO must not be rancid and have a distinctive coconut odor.

### 3.2 Water Content Test

The results of VCO water content test can be seen in Table 3

**Table 3.** VCO Water Content Test

Variation of Adding Yeast Starter (% v / v)	Water content (%)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	0.01	0.08	0.01
6	0.008	0.02	0.01
9	0.002	0.008	0.001



**Figure 4.** Water Content Test Graph

Water content is an important parameter because it has an important role in determining the quality of VCO. The addition of the percentage of yeast starter on the three types of yeast starter used has an effect on the moisture content of the VCO produced, as shown in Table 3 and Figure 4.

From table 3 the more the percentage addition of starter yeast, the less water content will be contained in VCO. The lowest water content is shown in the tempeh yeast starter 9%, namely 0.001%, the requirements for standardizing the quality of water content based on SNI [5] are 0.2%, while based on APCC (*Asia Pacific Coconut Community*) 0.1 – 0.5% [4]. Low water content in oil can extend shelf life by preventing the hydrolysis and oxidation processes that cause rancidity

### 3.3 VCO Volume

The results of VCO volume can be seen in Table 4.

**Table 4.** VCO Volume Results

Variation of Adding Yeast Starter (% v / v)	Result of VCO Volume (ml)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	79	80	79
6	89	85	90
9	93	99	95

From Table 4 it can be seen that the more the starter yeast percentage increases, the more VCO volume results will be obtained. The highest yield was obtained in the 9% yeast starter, namely 99 ml, while the lowest was in the 3% yeast starter, which was 79 ml.

### 3.4 Viscosity Test

Viscosity is an important parameter to determine the quality of VCO. Viscosity is expressed in SI units of mm<sup>2</sup>/s. Table 5 shows an increase in the viscosity of the yeast starter by 6%. The highest viscosity in star yeast tempeh was 6%, namely 73.5 mm<sup>2</sup>/s, and the lowest was at 3% starter yeast tape, which was 41.8 mm<sup>2</sup>/s. The thicker the oil, the better the oil quality.

**Table 5.** VCO Viscosity Test

Variation of Adding Yeast Starter (% v / v)	Viscosity (mm <sup>2</sup> /s)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	41.8	65.8	58.4
6	59.3	63.6	73.5
9	53.5	60.3	50.4

### 3.5 Acid Numbers

The acid number is an important parameter in the quality of VCO. The acid number shows the amount of free fatty acids in the oil and is expressed in mg base / gram of sample. In Table 6, it can be seen that the VCO acid number in the starter yeast tape and tempeh is getting higher, with the addition of the starter yeast percentage.

**Table 6.** VCO Acid Number Test Results

Variation of Adding Yeast Starter (% v / v)	Acid Number (mg KOH / Sample)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	0.5	0.8	0.56
6	0.56	0.56	0.7
9	0.6	0.8	0.8

Meanwhile, the bread yeast starter fluctuates (unstable). These results indicate that the VCO produced in this study has a fairly good acid value because it meets the requirements of SNI (7381: 2008) which is < 2.0 mg base / oil sample.

### 3.6 Peroxide Numbers

The results of the analysis of the VCO peroxide number in this study are presented in table 7. From this table, it shows that the higher the addition of the starter yeast percentage, the smaller the peroxide number in the VCO. A high peroxide number identifies the oxidized oil expressed by meq / kg of oil sample.

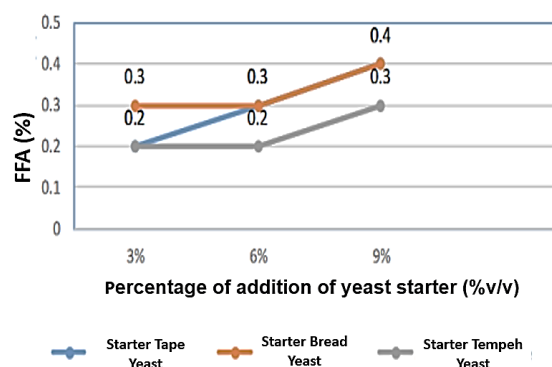
**Table 7.** Peroxide Number Test

Variation of Adding Yeast Starter (% v / v)	Peroxide Number (meq/kg)		
	Yeast Tape Starter	Bread Yeast Starter	Starter Tempeh yeast
3	0.6	0.6	0.2
6	0.4	0.6	0.2
9	0.2	0.2	0.1

Peroxide smallest starter yeast tempeh 9%, ie 0,1 mEq / kg, while the highest peroxide value on starter yeast 3%, and the starter yeast tape 3% is 0.6 mEq / kg. These results are still in good quality requirements according to SNI. Standardization requirements based on SNI [5] are 2.0 meq / kg, while based on APCC (Asia Pacific Coconut Community) [4] is 3.0 meq / kg. So that the results of the analysis of peroxide numbers in this study can be said to meet the good quality requirements.

### 3.7 Free fatty acid

The addition of the starter yeast presentation in the production of VCO by fermentation method has an effect on the free fatty acid content in the VCO produced. Free fatty acids are fatty acids that have been released from triglycerides due to the hydrolysis process.



**Figure 5.** Free fatty acid Graph

Free fatty acids are very important to standardize the quality of VCO. High free fatty acids indicate poor oil quality. These free fatty acids are expressed as% FFA. From Figure 5 shows the more the addition of starter yeast percentage, the higher the percentage of free fatty acids. In the addition of 3% and 6% yeast starter, free fatty acids ranged from 0.2 - 0.3%, while the addition of starter yeast and tape yeast 9% free fatty acids was 0.4%. The results of the VCO fatty acid content test in this study have met the requirements of SNI 7381: 2008, namely 0.2% and standardization based on APCC (Asia Pacific Coconut Community), namely 0.5%. [4].

#### 4. CONCLUSIONS

Based on the results of the research that has been done, it can be concluded that the addition of the percentage can affect the quality of the VCO produced. The test for the characteristics of the fermented VCO characteristics has a value that meets the quality requirements of SNI (7381: 2008).

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