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An Effort to Increase the Potential of Virgin Coconut Oil with Pendawa Technique

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Abstract. In order to overcome the disadvantages of conventional method, innovations on how to produce coconut oil were applied with the technique of PENDAWA (*Pendayagunaan Asam Jawa*). Coconut oil comes from coconut milk which is the substance between oil and water (emulsion). So to get coconut oil, acid is needed as an emulgator to break down emulsifying substances. In this case, Tamarind is used because it is cheap, available, contains a lot of antioxidants, and is efficacious. Coconut oil contains medium chain saturated fatty acids, namely MCT (Medium-chain triglycerides) where MCT provides extraordinary health enhancing properties. We compared three types of coconut oil, namely coconut oil in the traditional way, coconut oil with the addition of tamarind, and packaging oil on the market. The result was coconut oil with the Pendawa method very good in quality and quality with FFA 0.0067% and peroxide number of 1.5 mg ek/kg. In conclusion, this oil production with the PENDAWA method is very effective, efficient, high in quality, and provides high profit for the industry that wants to produce it.

1. Introduction

Indonesia is one of the tropical countries with various types of plants and one of them is coconut. Coconut plants are often referred to as the tree of life, because they are very beneficial for human life. Coconut fruit which is one of the important part of coconut tree can produces VCO (Virgin Coconut Oil). Oil is one of the important ingredients for the needs of the human body. Oil is also source of energy. According to Kusnandar [1], one gram of oil can produce 9 kcal.

Virgin coconut oil is a food that is almost inseparable from people's lives. Apart from being a kitchen item and other necessities, coconut oil needs are high, especially when consuming fatty foods into culture. This theory can be prove by the rising price of virgin coconut oil in the world market. This necessary is getting higher because of various industrial fields that utilize coconut oil. In the food industry, coconut oil is used in the process of making margarine, milk powder, cosmetics, and other household materials.

Virgin coconut oil or medium coconut oil contains medium chain fatty acids that are easily digested and oxidized by the body so as to prevent accumulation in the body. It also turns out that the antioxidant content in VCO is also very high, such as tocopherol and beta-carotene. The antioxidants can prevent premature aging and maintain body vitality, according to Setiaji and Prayugo [2]. The highest source of MCT (Medium-chain triglycerides) is found in coconut oil. Marten et al [3] commented that MCT has the potential to be used for weight management, because it will reduce body weight. According to Bach et al [4], many studies have shown that MCT is useful to use if the digestion, absorption, or transport of



LCT is disrupted. In addition, MCT does not contain TFA which causes coronary heart disease. These advantages also make coconut oil has a great economic opportunity. Coconut oil is still carried out traditionally by many people, especially people living in rural areas. The method that usually used by people is traditional methods or usually known as traditional wet or krengseng. This method is very simple so that it can be done using equipment commonly found in the kitchen. However, the results of this method are very small in quantity and lack of nutritional value. Making coconut oil in general can be done in a dry and wet way, according to Kusumastuti [5]. Coconut oil produced by wet method is less efficient because it requires a long time of heating, requires a lot of fuel, so the cost is quite high and produces low quality oil which is easy to become rancid because it contains a lot of water. Meanwhile, if you use the dry method the water content in coconut will be much reduced. Unfortunately the oil produced will be less and still contain residual impurities. Of course these things will become obstacles in the process, product quality, and production results. Another way that can be done is to utilize the activities of microorganisms known as fermentation, but the fermentation method also requires considerable time but does not require a heating process to get the oil, according to Arsa et al [6]. Overcoming these problems, we applied an innovation in how to produce coconut oil with the technique of PENDAWA (Pendayagunaan Asam Jawa). According to Winarmo [7], making coconut oil by acidification produces oil faster, because acidic conditions can cause proteins to lose their properties as emulsifiers so that oil and water are separated. Coconut oil derived from coconut milk which is the substance between oil and water (emulsion). Acid is added to work as an emulgator to break down the emulsifying agent. In this case, tamarind is used because it is cheap, easy to obtain, and contains lots of antioxidants.

2. Variables of Experiment

The first step is to prepare the research variables as follows:

Control variable: Coconut oil fermentation method adding tempe yeast.

Independent variable: Coconut oil with acidification of tamarind.

- 1000 ml of coconut milk with 20 ml of tamarind
- 1000 ml of coconut milk with 30 ml of tamarind
- 1000 ml of coconut milk with 40 ml of tamarind
- 1000 ml of coconut milk with 50 ml of tamarind

Dependent variable: Volume generated, The quality of coconut oil produced by organoleptic tests.

3. Equipment

The tools used in this PENDAWA technique are coconut grater, filter cloth, basin, stove, erlenmeyer, clamps and stands, funnels, glass stirrers, pans, plastic cups, beaker glass, thermometer, measuring cup, reagent spoon, drop pipette, burette.

4. Material

The materials used are old coconut, aquadest, yeast tempe, tamarind, market packaging coconut oil, Na₂SO₂O₃, KOH 0.25 N, PP indicator, 95% alcohol.

5. Experimental Stage

The first is the stage of making cream / kanil. We must prepare and choose old coconut meat. Then peel the coconut skin from the meat and grate the coconut meat. After that, squeeze the grated coconut meat on a filter cloth and add water to the grated coconut, 1 liter of water to 1 kg of coconut. Then we filter the coconut milk produced.

After the coconut milk is filtered, we have to deposit 72 liters of coconut milk which produces 12 liters of coconut cream to be used to make coconut oil with acidification of tamarind, another 18 liters of coconut milk is made by fermenting the addition of tempeh yeast. Then divide 12 liters of coconut cream into 4 equal parts and add tamarind with a different ratio.

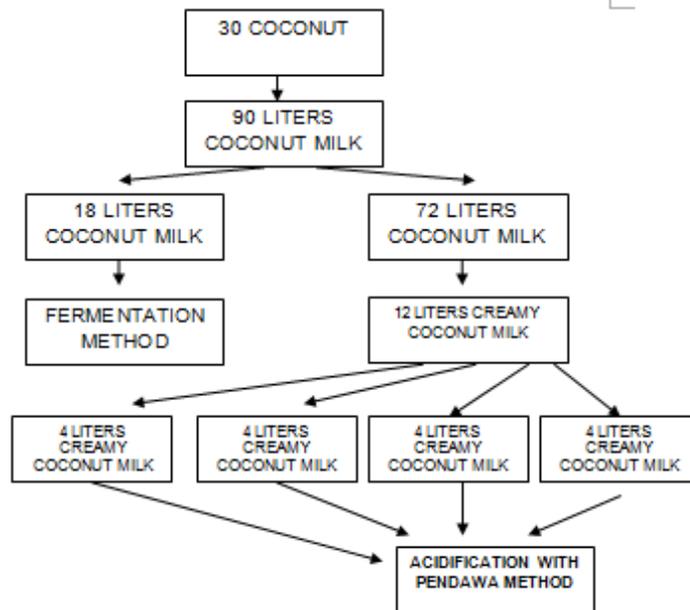


Figure 1. Scheme of making creamy coconut milk for fermentation and acidification way

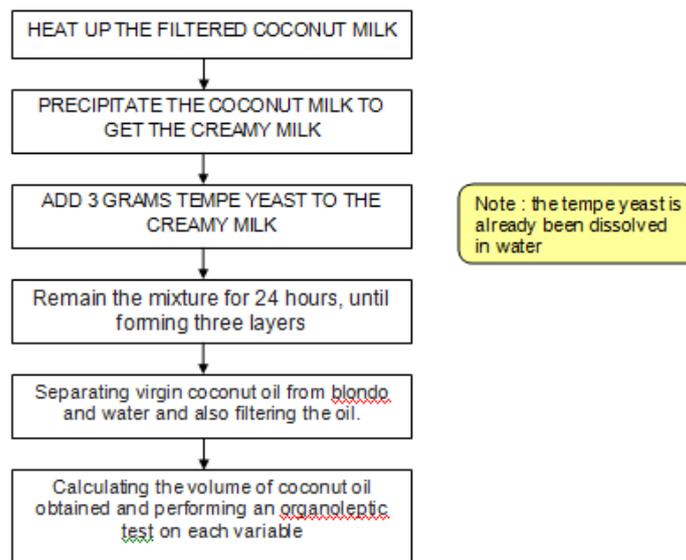


Figure 2. Scheme for making creamy coconut milk for experiment with tempe yeast

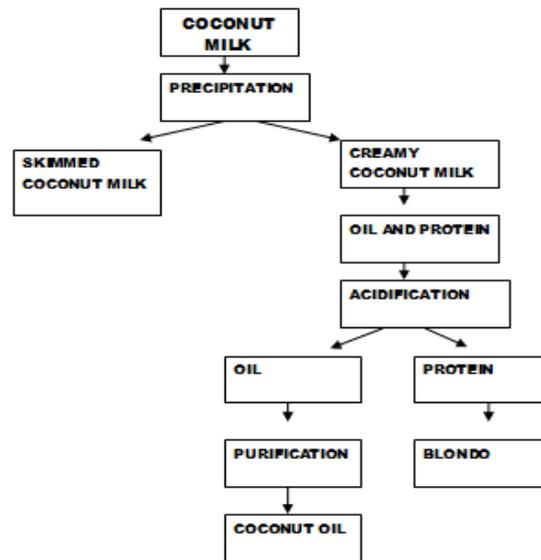


Figure 3. Scheme of making coconut oil with PENDING technique

6. Results and Discussion

Based on the experiment, data is obtained as below:

Table 1. Fermentation method with the addition of tempe yeast

| No | Oil Produced | Taste | Smell | Colour |
|---------|--------------|------------|---------|--------|
| 1 | 149.50 ml | Not rancid | Coconut | Yellow |
| 2 | 148.00 ml | Not rancid | Coconut | Yellow |
| 3 | 152.50 ml | Not rancid | Coconut | Yellow |
| Total | 450.00 ml | | | |
| Average | 150.00 ml | | | |

Table 2. Acidification method using tamarind

| Treatment (Millilitre: millilitre) | Average (ml) | Taste | Smell | Colour |
|---------------------------------------|-----------------|------------|---------|--------------|
| 1000 : 20 | 150 | Not rancid | Coconut | Clear Yellow |
| 1000 : 30 | 300 | Not rancid | Coconut | Clear Yellow |
| 1000 : 40 | 250 | Not rancid | Coconut | Clear Yellow |
| 1000 : 50 | 225 | | | |

6.1. Volume

Based on table 1, the production of coconut oil fermentation method with the addition of tempe yeast produces less coconut oil volume than the acidification method due to various factors, including enzyme work from *Rhizopus Oligosporus* which is influenced by temperature. The optimum temperature for growth of *Rhizopus Oligosporus* is 30-35 °C according to Presscott and Dunn [8]. Dede et al [9] said that coconut oil produced is quite a lot but has a bad shape. Based on table 2, addition of tamarind has an effect on the results obtained. Comparison of coconut milk cream: tamarind (1000: 20) does not experience increased yield. Comparison of coconut milk cream: tamarind (1000: 30) can increase yield by 150 ml. Comparison of coconut milk cream: tamarind (1000: 40) can increase yield by 100 ml. Comparison of coconut milk cream: tamarind (1000: 50) can increase yield by 75 ml. In other words, it was found that coconut oil produced by adding tamarind reached the highest volume in treatment 2 where the comparison of coconut milk cream: tamarind (1000: 30). As we can see from table 1 and 2 that the most oil produced is by using tamarind (*PENDING* method) with the average of 250 ml oil.

Tamarind has the ability to break the fat protein bonds in coconut milk by binding to compounds that bind to fat so that the oil can be separated, according to Setiaji and Prayugo [2].

6.2. Taste

Taste or aroma is one of the parameters of the good quality of coconut oil. Similar to tamarind, coconut contains anti-oxidants that are useful in the process of preserving coconut oil so it does not quickly become rancid, said Sudarmadji et al [10]. Based on table 1 and 2 on the taste column, we can see that the taste of the VCO by using PENDAWA method is not rancid at all, same with the method of fermentation by using tempe yeast. The parameter of a good VCO is it doesn't taste rancid. And it will make *PENDAWA* method become the best way to produce VCO because the taste is not rancid and the volume produce is even higher than using another method. The production cost of our acidification method is also low because it does not require fuel for heating process. The selling price is even higher.

6.3. Smell

The smell from the fermentation method of adding tempe yeast used is a distinctive aroma of coconut because coconut milk when heated will be fragrant, but the more we eliminate the heating process in the acidification method with the addition of tamarind, the better the quality of the oil and the aroma of coconut oil. A good VCO emits a coconut aroma. Many people worry if the VCO produced by using tamarind will emits an acid aroma. But it doesn't happen in this case because as we can see in table 1 and 2 in the smell column, the experiments by using tamarind (*PENDAWA*) method produces distinctive aroma of coconut.

6.4. Color

The color of coconut oil from the acidification method is clearer than the coconut oil made by the fermentation method. The color of oil formed in the acidification method is caused by the absence of heating, because during the heating process the components of carbohydrates, proteins and oil will experience hydrolysis and oxidation which will affect the color of the oil. But, because *PENDAWA* method doesn't need any heating process, the color is clearer than using any other methods. This clear color can add some positive points in the VCO and make the price become higher. This *PENDAWA* method again proves that it has so many advantages.

6.5. Free Fatty Acid (FFA)

Table 3. FFA (Free Faatty Acid) test result

| Experiment | Acidification with Tamarind (%) | Packaging oil (%) | Addition of tempe yeast |
|------------|---------------------------------|-------------------|-------------------------|
| I | 0.0680 | 0.230 | 0.100 |
| II | 0.0650 | 0.250 | 0.120 |
| III | 0.0670 | 0.220 | 0.090 |
| Total | 0.2000 | 0.700 | 0.310 |
| Average | 0.0667 | 0.233 | 0.103 |

Acid numbers are carried out to determine the amount of free fatty acids contained in the sample. The results obtained in the sample of coconut oil with tamarind acid acidification were 0.0667, packaged coconut oil on the market 0.233, and coconut oil with the addition of tempe yeast by 0.103. It can be seen that coconut oil with acidic addition of acidification (*PENDAWA*) method has the lowest FFA level and is in accordance with the SNI Coconut Oil standard 7381: 2008 [11] which the maximum acid number value is 0.2. A large acid number indicates free fatty acids derived from hydrolysis of oil or due to bad processing. The smaller acid number shows the better quality of VCO.

6.6. Peroxide Number

Table 4. Peroxide number test result

| Experiment | Acidification with Tamarind (mg ek / kg) | Packaging oil (mg ek / kg) | Addition of tempe yeast (mg ek / kg) |
|------------|--|----------------------------|--------------------------------------|
| I | 1.70 | 3.70 | 3.30 |
| II | 1.30 | 3.50 | 3.40 |
| III | 1.50 | 3.40 | 3.60 |
| Total | 4.50 | 10.60 | 10.30 |
| Average | 1.50 | 3.53 | 3.43 |

Determination of peroxide numbers can be determined by iodometry, i.e. by oxidizing oil with KI and Iod released. Then titrated with a standard solution of Sodium Thiosulfate. A saturated solution of KI is used to free iodine which is indicated by the formation of yellow color in the sample. Coconut oil produced by using PENDAWA method is in accordance with SNI coconut oil 7382: 2008 [12] is a maximum of 2.0 (mg / kg). While packaging coconut oil on the market and coconut oil fermentation method with the addition of tempe yeast are not in accordance with SNI 7382: 2008 [12] coconut oil which is a maximum of 2.0 (mg ek / kg). This is caused by a number of unsaturated fatty acids in the sample that bind oxygen to their double bonds to form peroxides and the high number of peroxides shows the lower the quality of an oil or fat. High peroxide numbers indicate that oil has undergone oxidation, which is not good for health, but it doesn't happen by using PENDAWA method. The smaller peroxide number shows the better VCO.

7. Conclusion

Coconut oil produced through the PENDAWA technique, the most optimal is the comparison of coconut milk cream: tamarind (1000: 30) which can increase the yield by 150 ml. In addition, the presence of antioxidants in tamarind can increase product quality while increasing product quantity.

In the oil quality test, the quality of the coconut oil using the PENDAWA technique, with FFA content of 0.0067% and peroxide number of 1.5 mg ek / kg, which fulfills the applicable standard. The advantages of the coconut oil industry with the PENDAWA technique are related to quality, quantity, and efficiency in terms of time.

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