

The Physical and Chemical Properties of Virgin Coconut Oil (VCO) Product Obtained Through Fermentation and Enzymatic

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ABSTRACT

Virgin Coconut Oil (VCO) is an oil product derived from coconut without experiencing high-temperature processes and chemical adding. The making of VCO can be done by various methods. One of them is using an enzymatic method that can be combined with fermentation techniques. The purpose of this study was to identify the physical character and chemical properties of the product from a combination of fermentation and enzymatic by using the bromelain enzyme derived from pineapples extract. The fermentation is carried out for 20 hours. The results showed that pineapples extract showed that bromelain enzyme showed by the colour change of pineapples extract to be brown and there were black sediment, the pH average of pineapples extract was 3.6, the highest VCO in the additional treatment was 50% pineapples extract to 70 ml and the lowest at pineapples extract 20% by 52 ml. The general, the flavour and colour are neutral, there was still the distinctive of pineapples. The highest moisture content in VCO oil is 0.36% in addition to pineapples extract 40% and the lowest is 0.14% from the addition of 30% pineapples extract. While the highest FFA level was at the addition of 20% pineapples extract concentration with FFA value of 0.36%, while the addition of 50% pineapples extract which produced FFA content was 0.32%. The results of the study concluded that the VCO produced was good, but the physical characteristics of the aroma did not meet the requirements.

Keywords: Coconut, Bromelain Enzyme, Fermentation, VCO

INTRODUCTION

The meat of a coconut is part of the coconut that can be utilised in the making process of coconut milk produced by squeezing technique. Coconut milk has already been used in the cooking process of various kinds of cuisine, but recently, it can be used as a pure coconut oil product dubbed as a high-quality virgin coconut oil (VCO) (Hariyadi, 2008). The VCO production process must fulfil the requirements in the producing or processing steps, which is using old coconut with the age range of 12 months (Barlina, Lay, Hengky, Kembuan, & Mahmud, 1995).

The VCO, a product derived from coconut meat, have been positively acknowledged by most of the people due to the fat inside the oil can be used as a herbal material for health. VCO has many advantages, among others, are containing high laurate acid, which is metabolized in the body, it will be degraded to be a monolaurin compound of monoglycerides, which functions as antiviral, antibacterial, and antiparasitic (Setiaji & Prayogo, 2006). The appearance of monolaurin or monoglyceride compound will increase the body's immunity towards illness and can accelerate the recovery and healing process (Silaban, Manullang, & Hutapea, 2014). On the other hand, VCO also contains an antioxidant compound that can be used as an antidote to free radicals element. Antioxidant of the coconut oil will help the human body in overcoming premature ageing due to free radicals (Syah, 2005).

The VCO itself can be used in industrial sectors such as cosmetics, pharmacy, food industry, or even the soap industry (Moeksin, Rahmawati, & Rini, 2008). To avoid the

excessive loss of VCO compounds, then alternative ways to gather the VCO is by the right processing technique. Enzymatic and fermentation method is thought to be an appropriate method in VCO processing because this method does not produce excessive heating so that the damage of the important compounds can be avoided.

The utilisation of enzyme on the pineapple (Bromelain enzyme) can degrade protein compounds available in coconut milk and break the coconut milk's cell walls so it can separate water and oil. This enzyme is available in pineapple's hump and fruit. But the concentration of the enzyme is higher in the hump than in the fruit.

METHODS

Materials and Tools

The main materials used in this research are pineapple and thick coconut milk. Meanwhile, the chemical materials used are NaOH 10%, Pb Acetate 5%, distilled water, KOH 0.1 N, n-hexane, alcohol 96%, and phenolphthalein indicator.

Tools used for this research are measurement glass, heater, 50 ml burette, Erlenmeyer pumpkin, pH meter, analytical scale, aluminium foil, and filter.

Preparation of Bromelain Enzyme and pH Testing

Bromelain enzyme is gathered from the pineapple's extract. The pineapple is peeled then scaled. Afterwards, it was cut into small pieces then blended until resulted in porridge substance. The porridge then squeezed by flannel cloth and filtered to gather its coarse extract. Its volume then measured and its average pH of the extract is gathered from the pH meter.

Identification of Coarse Bromelain Enzyme

The pineapple contains bromelain compounds/enzyme naturally. The identification of coarse bromelain enzyme on this fruit is conducted on its extract by sulphur test (PbS). Its work procedure is the addition of 5 ml of NaOH solution 10% to the 2 ml of pineapple coarse extract solution and then heated for 5 minutes. Afterwards, two drops of Pb Acetate 5% added to the mix. The mix then heated until the extract solution becomes discoloured.

Making coconut milk and coconut milk cream

The coconuts used in this research are three old coconuts purchased at Gresik market. Its meat then grated to produce 2 kilograms of grated coconut meat. The grated meat then processed into coconut milk with a ratio of 1:1 between water and grated coconut. From the squeezing process, the produced coconut milk then moved into a container and covered by aluminium foil for 2 hours until it formed as two layers; the upper layer of thick coconut milk (cream) and lower layer of skimmed coconut milk (liquid). The cream resulted in this process then utilised for VCO producing process (Bolung, Mamujaja, Mandey, & Mamahit, 2013).

The Making of Fermented VCO and Oil Volume Measurement

The making of fermented VCO uses thick coconut milk (cream) of the previous process. The cream then taken as much as 450 ml for each beaker glass then stir about 10 minutes until it homogenised. Afterwards, give each beaker glass different concentration of bromelain enzyme of the pineapple extraction. The used concentrations are 20%, 30%,

40%, and 50% and then stir again until it homogenised. Afterwards, cover it with aluminium foil and let stand for 22 hours. After 22 hours, it will form three layers. The upper layer is the oil, the middle layer is the clot of oil and protein ("galendo"), and the lower layer is the water. The upper layer of oil then gathered and filtered and then put into measurement glass to measure the amount of oil gathered in each treatment.

Determination of Water Content

Water content in the fermented VCO is determined by scaling dried and cleaned empty petri dish and add or scaled the sample above as much as 5 grams and then scaled. Afterwards, it was put into the oven for 2 hours on 105 degrees centigrade. After reached the favoured time and temperature, the sample then cooled in the desiccator for 15 minutes and then scale the resulted weight.

Determination of Free Fatty Acids Content

The determination of Free Fatty Acids (FFAs) content in the VCO is conducted by scaling 10 ml of oil sample and put into 250 ml Erlenmeyer pumpkin. Afterwards, put 20 ml n-hexane and 30 ml alcohol 96% and 2 ml of phenolphthalein (PP) solution. Titrate the solution using NaOH 0.1 N solution until it discoloured into pink or crimson and did not change or gone for half a minute. Take note of how much NaOH 0.1 N is used and count the percentage of FFAs.

RESULTS AND DISCUSSIONS

Bromelain Enzyme Identification

Identification of coarse bromelain enzyme is conducted on pineapple extract. This enzyme is a compound/enzyme classified in a glycoprotein that has a peptide chain, which enables the possibility to be identified by the basic of the protein group appearance. In the bromelain enzyme, there is an active side of the enzyme that contains groups of cysteine and histidine. Both of the groups play an important role in the enzyme's activity or metabolism. On this research, the coarse bromelain enzyme is tested using PbS or Pb CH_3COO_2 analysis. From the gathered identification results, it is proved that pineapple contains bromelain element or compound. Positive identification is indicated through discolouring, which is the formation of the colour of brown and black coloured sediment solution.

The pH Analysis of Pineapple's Extract

Young pineapple extract is gathered by getting the pineapple blended and filtered with Buchner filter to gather its essence. It then re-filtered using flannel cloth. The extract then measured with a pH meter. The result shows that pineapple extract has an average pH of 3.6. This step then repeated for six times.

VCO Volume Measurement

Fermentation of thick coconut milk (cream) conducted for 20 hours. The purpose of this fermentation is to extract the oil from the coconut milk with the assistance of a natural enzyme extracted from the young pineapple. In this fermentation, it resulted in three layers; the upper layer is the oil, the middle layer is the clot of oil and protein ("galendo"), and the lower layer is the water. Oil measurement is conducted to the four samples/treatment container. Treatment 1 using 20% pineapple extract concentration, the second one using

30% pineapple extract concentration, the third one using 40% extract, and the latter one using 50% extract. The utilisation of the pineapple is because pineapple contains bromelain compound/enzyme that can break the protein in the fat. This destruction only occurs on the protein part, not the fat part. Due to the denaturation, it will be followed by the destruction of the lipoprotein inside. The volume of pure oil result can be viewed in Table 1.

Table 1. Compared results of VCO extracted

Sample	Pure Coconut Milk (ml)	Pineapple Extract (ml)	VCO extracted (ml)
1	450	90	52
2	450	135	64
3	450	180	67
4	450	225	70

From the table, it was obvious that the more pineapple extract concentration is given, the more oil can be extracted. It is in accordance with research done by Kusuma, Kurniawati, Rahmi, Rusdan, & Widyanto (2017), which more oil gathered if more enzyme added. However, if looked from the amount of used coconut milk, it is in stark contrast with the oil extracted, which arguably small. This perhaps comes as a result of utilised pineapple extract. In this research, the part of pineapple used is the entirety and not exclusively on the hump, which contains more bromelain enzyme than the meat. It is also possible that bromelain enzyme activity in the pineapple extract is less optimal in its activity to break lipoprotein contained in the coconut milk emulsion.

Measurement of Water Content in VCO

The purpose of the water content analysis is to recognise the water content in the VCO. According to APCC (2009), the water content in the VCO shall not exceed 0.5%. Otherwise, the VCO quality will be lower. The results of VCO producing by enzymatic and fermentation technique are shown in Table 2.

Table 2. Results of the Measurement of the Water Content in VCO

Samples	Container's Weight	Oil's Weight	Final Weight	Water Content (%)
1	60.12	4	64,07	0,34
2	60.35	4	64,26	0,14
3	60.11	4	64,02	0,36
4	60,22	4	64,16	0,33

Based on the results above, the water content measured is below 0.5%, and the highest water content percentage is shown in Treatment 3 (pineapple extract concentration of 40%). Meanwhile, the lowest water content occurred on the treatment which is given a pineapple extract concentration of 30%. Reviewing all water content gathered that is less than 0.5%, this shows that VCO results gathered have been fulfilled the specified standard. But, there are significantly different results gathered between all four treatments. It can be occurred due to unstable decreasing temperature in the oven. This decreasing temperature enabling the possibility of the slowing evaporation pace. However, the specified time has been in accordance with the conducted procedure.

Colour Visual and Aroma of the VCO

Colour and Aroma are the special characteristics of the VCO. Colour is the main visible visual of a product. In this case, a good VCO has no colour (clear) and no aroma. In this research, the resulted colour and aroma is specific. The resulted colour is clear but a bit yellow, and it smells like pineapple, which both elements are derived from the bromelain enzyme of the pineapple. Colour and aroma of the formed VCO are neutral or normal.

FFAs of the VCO

Free Fatty Acids, or FFAs, which is an acid that can be freed during hydrolysis condition, its content should be under 1% in oil. Otherwise, the rancidity process will be easier to occur. Moreover, the cholesterol level will also increase. Basically, FFAs is a base that utilised to know the age of an oil, purity level of oil, and hydrolysis level used.

The determination of FFAs content by using alkalimeter principles, which is the occurrence of neutralisation reaction due to the reaction of H ion that comes from the oil's acid with HO (hydroxide) ion from the base that comes from the used titer. On the other hand, in the determination of the FFAs, oil sample then dissolved into ethanol with the purpose to dissolve the non-polar and oil-soluble FFAs which later soluble in the NaOH phase that used as the titration solution. The FFAs analysis can be seen in Table 3.

Tabel 3. Calculation Results of Titrated FFAs

Sample	Content 1 (%)	Content 2 (%)	Content 3 (%)	Average (%)
1	0,36	0,33	0,38	0,36
2	0,39	0,32	0,34	0,35
3	0,35	0,31	0,35	0,34
4	0,31	0,30	0,36	0,32

It is clearly visible that in the FFAs analysis of the oil experiences small decrease along with the addition from the given pineapple extract concentration as much as 20%, 30%, 40%, and 50%. Viewing from the average result of FFAs, it shows that VCO resulted from the enzymatic and fermentation technique is in accordance with the standards set of below 1%.

CONCLUSION

The addition of the increased concentration of pineapple extract is able and increase the VCO quantity. VCO analysis that resulted from FFAs and water content side is in good quality. From the organoleptic side, everything is good and normal, either in colour and aroma formed in the VCO.

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