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INTRODUCTION OF CaO FROM OYSTER AND ECOENZIM FOR MAKING VIRGIN COCONUT OIL

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Virgin coconut oil (VCO), Kalsium oksida (CaO), Eco-enzyme DAN, DPN.

ABSTRACT

Virgin coconut oil (VCO) is a processed form of coconut meat that is pure and free of free fatty acids. VCO is widely recognized as a cooking oil, cosmetic, antioxidant and beneficial for health, due to its high content of lauric acid. The method used in this research is a combination of qualitative and quantitative methods. The stages carried out in this research start from literature study, field research, laboratory analysis, data processing, and reporting. The purpose of this research is to produce VCO by utilizing CaO from oysters and Eco-enzyme to de-emulsify proteins to separate oil from water and measure the decrease in free fatty acid number and the decrease in peroxide number as quality parameters of the VCO produced. The application of CaO and Eco-enzyme fermentation is simple by mixing 0.2 g, 0.4 g, 0.6 g CaO and 0.2 mL, 0.4 mL, 0.6 mL Eco-enzyme respectively with 100 mL coconut milk. After treatments, it can be concluded that: separation of water from oil in the manufacture of VCO from coconut milk can occur using CaO and using Eco-enzyme It means that de-emulsification of protein in coconut milk is working well. To determine the quality of production VCO from CaO de-emulsification found 50.00 % the decreasing of Free Fatty Acid number and the decreasing of peroxide number is 28.57 %. From eco-enzyme de-emulsification the results are 55.55 %, the decrease of the acid number (DAN) and 57.14% the decrease of the peroxide number (DPN).

INTRODUCTION

Central Sulawesi occupies the 4th position in the provinces (after Riau, North Sulawesi and Maluku) which produces 195,000 tons of coconut per year with a land area of 217,228 Ha (Id, 2017). This product is sold from Central Sulawesi in the form of copra in seeds, but in the form of seeds it becomes polemic because the retailer only buys Rp. 500 – Rp. 700/seed. So that the government and Commission VII of the House of Representatives have been prohibited selling in whole/seed form (Kontan.co.id, 2020).

The scarcity of cooking oil also led to an increase in the price of copra from Rp.3,500 to an average of Rp. 11,400/kilogram, so farmers returned to selling coconut commodities in the form of copra (Basri Marzuki, 2020).

According to Kindangen et al. 2000, in fact coconut production can be increased 2 to 4 times, with the calculation that now copra production is now around 1 ton/ha/year, compared to the potential production of 2-4 tons/ha/year if using the recommended technology (Kamela, 2021). In addition to maximizing production per hectare, Indonesia has also not tried seriously to seek "value added coconut products" with technology to produce products with high selling value, such as, according to Arancon, R. N. (1999), alternative products (other than oil) from coconut with added, there are 12 kinds of high value and prospects in the global market, five of which are 1). Desiccated coconut meat 2). Coconut milk or canned coconut cream 3). Coconut milk powder 4). Fresh young coconut and 5). Coconut water; these products are competitive with copra. The other six kinds of products are 1). nata de coco, 2). coconut coir, 3). fiber products, 4). fiber dust, 5). shell charcoal, and 6). activated carbon. Another product is kopyor coconut (makapuno – in the Philippines), which is an “abnormal” coconut that cannot be used for copra but can be used as an ingredient in drinks or dessert products that are highly valued. The chemical composition of kopyor coconut, both the flesh and the water has been studied (Santoso et al., 1996).

The solution to the problem above is that there needs to be a comprehensive effort from those involved in R & D, both in the development of coconut production and in the development of value added coconut products. Then after obtaining a comprehensive form of development, run one by one until a solution to the problem is reached. One product that requires an integrated development effort is virgin coconut oil, which contains very high lauric acid (45-55%). and used as raw materials for the food, cosmetic, and pharmaceutical industries (Soro et al., 2016).

Coconut (Cocos nucifera L) is an Indonesian commodity that has high economic value. Virgin Coconut Oil (VCO) is one of the processed products from coconuts that has the potential to increase people's income so that they have opportunities for new productive businesses. VCO is an oil obtained from the flesh of fresh old coconuts that have gone through a squeezing process with or without the addition of water, with a maximum heating of 60^oC or without heating, and is safe for human consumption. Many enzymes have been investigated to separate meat from oil, such as protoase from Moringa seeds, bromelain from pineapple and papain from papaya, etc (Suhardiyono, 1991).

In this study, CaO and eco- enzymes will be used which are currently trending as cleaning products. However, the process is the same as for other enzymes, namely from fruit. Basically what is used to make eco-enzymes is fruit peel or fruit waste, such as apples, water melons, rock melons, ripe papaya bananas. The aims of this study are to produce VCO using CaO as absorbent H_2O and eco-enzymes as de-emulgator of protein and to measure decreasing of free acid number and decreasing of peroxide number as the characterization of VCO.

METHOD RESEARCH

The research was conducted at the Chemistry Laboratory of the Faculty of Teacher Training and Education (FKIP) Tadulako University and the Laboratory of Science XRD and XRF at Hasanuddin University, utilizing both basic laboratory equipment and advanced instruments such as UV-Vis and XRD. The materials used included oyster shells, various fruits (papaya, apple, pineapple, mango, banana), palm sugar (eco-enzyme stock), distilled water, aluminum foil, coconut flesh, CaO from oyster shells, aquadest, 96% ethanol, phenolphthalein indicator solution, 0.1 N NaOH, chloroform, KI solution, sodium thiosulfate, acetic acid, and 1% starch solution. The research method combined qualitative and quantitative approaches, involving literature studies, field research, laboratory analysis, data processing, and reporting. For sample preparation, oyster shells were cleaned, dried, mashed, and sieved. Water and ash content were determined by drying and calcining the samples, respectively, and CaO levels were analyzed using XRF. To produce VCO, coconut milk was extracted from grated coconut flesh and mixed with eco-enzyme and CaO in varying amounts. The mixtures were stirred and allowed to stand before filtering and analyzing the quality of the resulting VCO.

RESULTS AND DISCUSSION

VCO Production

In the process of making coconut milk, grated coconut meat is added with water to extract coconut milk from solids or pulp. Coconut milk which consists of water and oil is basically immiscible, but because it contains protein as an intermediate which makes water-oil able to combine into a colloidal liquid called an emulsion. Protein acts as an emulsifier / emulsifying agent where the protein will wrap the coconut oil granules with a thin layer, as well as water so that the oil globules and protein-water granules can join the protein-oil granules.

The water used to extract will be separated by gravity, the water with the smaller BJ will be at the bottom of the container and the coconut milk on the top. This also means that the protein-oil grains are larger in number than the water-protein grains.

After separating the extraction water from the coconut milk/coconut emulsion, the coconut milk or emulsion needs to be broken so that the water and oil and protein are separated as emulsifiers.

Decreasing of Free Fatty Acid Number and Peroxide Number with Eco-enzyme

In this step, two methods were used to break the oil-water emulsion;

First, by using enzymes, as done by (Setiaji, 2006), using protease enzymes. Several proteases with varying catalytic characters can be used to break lipoprotein bonds in fat emulsions, including papain (papaya), bromelain (pineapple), and protease enzymes which comes from river crabs (Ward, 2011). These enzymes are known to be safe when used in foodstuffs (Whithaker, 1994).

In addition, the extracellular work of microorganisms with a high complexity to produce enzymes as biocatalysts in chemical reactions in living cells, is for cell metabolism and cell regulation in living things. super productive, thousand times (Boyer & Carlton, 1968).

Eco-enzymes, which are produced from the fermentation of several types of fruit (five types of skin and fruit flesh) (Palungkun, 1993) are confirmed to contain protease enzymes, namely papain enzymes because there is papaya flesh, and bromelain enzymes because there is pineapple flesh and skin. By these enzymes proteins are converted into peptides and amino acids through a hydrolysis process The particular reason for the use of Eco-enzyme, is that at this time it has become a public concern because of its other functions that have been worldwide. The combination of enzymes contained in it is certainly interesting to know its function as a catalyst for breaking down proteins into amino acids so that the emulsifier function is eliminated.

Production VCO with this enzymatic process consists of three main stages, namely making coconut milk, adding proteases (eco enzymes) and filtering.

Table 1
Result of VCO Acid Number Test with Eco-enzyme Coagulant

Volume Eco-enzyme (mL)	Free Fatty Acid Number		% Decreased Free Fatty Acid Number
	Before	After	
0.05	3.6	2.2	38.88
0.1	3.6	1.8	50,00
0.2	3.8	1.6	55.55

This enzymatic process is certainly superior to the separation process by heating, which for quality improvement must be done through refining, bleaching, and deodorizing. Another advantage is that it is useful for the body (Nevin & Rajamohan, 2004).

After coconut milk is mixed with eco-enzyme, the results of the decrease in acid number and peroxide number are obtained as shown in Tables 1 and 2. According to Chen and Diosady, 2003, to extract VCO by fermentation, it is carried out using papain enzymes which directly or through enzymes-producing microbes that can break protein bonds with oil in coconut milk emulsions.

Table 2
The Results of VCO Peroxide Number with Eco Enzyme Catalyst

Volume Eco-enzyme (mL)/100 mL	Peroxide number		% decreasing of Peroxide Number
	Before	After	
0.05	3.5	2	42.85
0.1	3.5	2.5	28.57
0.2	3.5	1.5	57.14

Making VCO from coconut milk is done in several ways: first, by heating gradually at a temperature of 60ºC-70ºC, then the oil and its granular will be separated.

Second, by centrifugation/me Chanical method by using a centrifuge, with a speed of 20,000 rpm and a time of 15 minutes and 3 layers will be formed, namely water, the granular and oil. The oil is separated using a pipette. Third, by means of a inducement, coconut cream is mixed with bait oil in a ratio of 1:3 while stirring until homogeneous, then allowed to stand for 7-8 hours until the oil, the granular and water are separated. Then they are separated mechanically. In this fishing technique, the oil molecules in the coconut milk are pulled by the fishing oil until they become all oil This pull will change the water and proteins that were previously bound to the coconut milk molecules to be disconnected (Sutarmi, 2006).

This method basically changes the shape of the oil-water emulsion into oil-oil. Some of the above principles serve as the basis for thinking in the use of enzymes as catalysts to convert protein polymers into amino acid monomers, as well as overhauling the emulsifying ability of proteins, so that oil can be separated from water.

Decreasing Acid Numbers and Peroxide Numbers with CaO absorption.

CaO can be used as a water absorber because it has a hexagonal structure which has a lattice inside which is interspersed with H+ and Na+ and others (Fitriyana & Safitri, 2015).

Table 3
The Result of Free Fatty Acid Number of VCO with CaO

CaO (gram)/100 mL Coconut milk	Number Peroksida		% decrease number of peroxide
	Before	After	
2	3.5	2.2	38.89
4	3.5	1.8	50.00
6	3.5	2.2	38.89

The acid number is expressed as the number of milligrams of KOH required to neutralize free fatty acids in one gram of oil. A large acid number indicates a large free fatty acid (Tenda & Kumaunang, 2007). This is reinforced by (Dahlan et al., 2013), that cellulose contains a lot of hydroxyl groups (-OH) which are electronegative (base) and polar. These properties can interact with the carboxylic acid (COOH) group of free fatty acids which are electropositive (acid) and polar. CaO fulfills both theory and practice above. If so, CaO can attract water to $Ca(OH)_2$ then it will be able to neutralize free fatty acids and can reduce the acid number to 57.14% at 2 grams.

The adsorption energy value obtained shows that the mechanism of the adsorption process that occurs is physical adsorption caused by attractive forces involving van der Waals forces of induced dipole-dipole interactions (Alimano & Syafila, 2014).

Table 3
The Results of Peroxide Number of VCO with CaO

CaO (gram)/100 mL	Number Peroksida VCO		% decrease number of peroxide
	Before	**After**	
2	3.5	2.5	28.57
4	3.5	2.5	28.57
6	3.5	3	14.28

The number of peroxides can be reduced because peroxides containing oxygen are polar compounds so that they are more easily bound to polar molecule such as CaO. If the adsorbent is polar, the polar component will be bound more strongly than the non-polar component (Jasinda, 2013) The results obtained did not achieve the desired results, but there is still evidence of a decrease in the oxidation number. This can be explained through previous research evidence that the decrease in peroxide number is influenced by the number of adsorbents and the length of contacting time. This is in accordance with the theory that the more adsorbent and the longer the contacting time, the purification process will be faster. The largest percentage decrease in peroxide value was the peroxide value of 7 mek O_2/kg at an adsorbent mass of 10 grams and a stirring time of 50 minutes. This has met the standard of SNI 01-3741-2013.

At the contact time of 40 and 50 minutes with a mass of 10 grams of adsorbent the decrease in peroxide number remained. This happens because the adsorbent has experienced a saturation period which causes the adsorbent to no longer absorb the acid number in the oil.

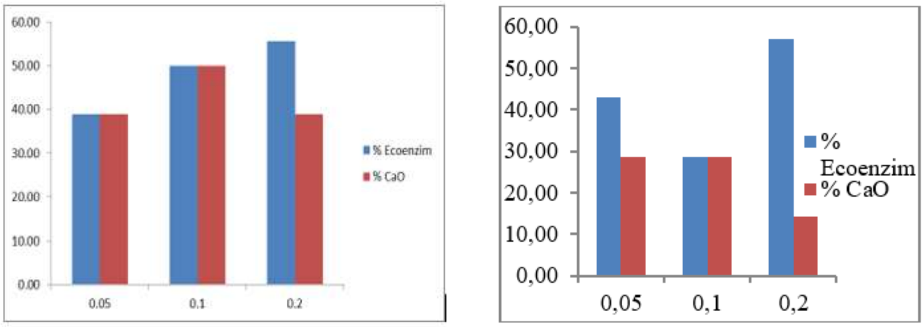

Figure 1
(a). Differences in Acid Number Reduction between Eco-enzyme catalytic and CaO . absorbance (b). Differences in peroxide value reduction between Eco-enzyme catalytic and CaO.absorbance

There was a striking difference in the reduction of peroxide value by eco-enzyme and CaO, eco-enzyme was more effective, especially at concentrations of 0.05 and 0.2. This happens because in the eco-enzyme there are several fruits that contain high anti-oxidants such as tocopherol compounds, vitamin C and also flavonoids that can ward off free radicals free and also prevent the reaction (Vijayaraghavan et al., 2011).

Mixing CaO with water in solution will turn into alkaline Ca $(OH)_2$, plus in this case it causes Ca $(OH)_2$ to react with esterification oil resulting in a decrease in acid number and a decrease in peroxide number.

CONCLUSION

The quality of VCO improved with the use of CaO, achieving a 50.00% reduction in free fatty acid number at 4 grams and a 28.57% reduction in peroxide number. When using eco-enzymes, the best results were observed with 0.2 mL, yielding a 55.55% reduction in free fatty acid number and a 57.14% reduction in peroxide number. This research was funded by the DIPA FKIP Tadulako University 2022 fund. The researcher expresses gratitude and appreciation to the leadership of FKIP Tadulako University for their motivation and funding, and thanks the dedicated research team for completing the research and writing this paper.

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