International Journal of Research and Review
Vol. 10; Issue: 6; June 2023
Website: www.ijrrjournal.com
Review Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Virgin Coconut Oil: A Review

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DOI: https://doi.org/10.52403/ijrr.20230610

ABSTRACT

Virgin Coconut Oil (VCO) is coconut oil that has undergone a minimal amount of processing without the use of artificial chemicals. VCO has the greatest lauric acid level of the two oils, with 53.70-54.06%, compared to regular coconut oil of 2.81% and palm oil of 0.45%. VCO is advantageous for health due to its high lauric acid concentration, which also increases endurance and hastens the healing of sickness. Coconut, which comprises water, protein, and fat, is a key component in the production of VCO. These three substances are an emulsion in which the emulsifier is a protein. A chemical known as an emulsifier serves to thicken or stabilize the emulsion. To prevent the blending of the oil and water droplets, a thin layer of coconut fruit protein will bind the droplets of coconut oil. If the emulsion bond is compromised, oil will leak out. On a small scale, centrifugation, fermentation, and enzymatic processes can be used to dissolve the emulsion.

Keywords: virgin coconut oil, lauric acid, fermentation, centrifugation, enzymatic

INTRODUCTION

Pure coconut oil or Virgin Coconut Oil (VCO) is an oil that produced from fresh coconut milk. Saturated fatty acids in VCO are dominated by Lauric acid that has a C12 chain. VCO has 53% lauric acid and approximately 7% caproic acid. Both are medium chain saturated fatty acids, also known as Medium Chain Fatty Acid (MCFA). Unlike manufacture process of other vegetable oils which generally go through the RBD process (refining, bleaching and deodorizing), the process of making VCO through a simple process without adding chemicals or using high temperatures [1]. VCO is the result of modification of the process of making coconut oil to produce products with low water content and low free fatty acid, clear color, good odor, and can be consumed within 12 months. Making VCO has many advantages, namely no requires high costs because raw materials are easily obtained at low prices, simple processing and not too complicated, meanwhile minimal energy use because it does not use a lot of materials, thus the chemical and nutritional content is maintained, especially good fatty acids. When compared to cooking oil (palm oil), VCO has better quality. From an oil economy perspective, VCO has a higher selling price than palm oil, thus studies on making VCO need to be developed [2].

DISCUSSION

VCO contains medium chain fatty acids easily digested and oxidized by the body so that it can prevent accumulation of fat in the body. VCO is a refined product coconuts that are free of trans-fatty acid (TFA) [3]. Regular consumption of VCO can reduce the risk of cancer, reduce risk of atherosclerosis, and heart disease. It can improve digestive function and nutrient absorption, keeps the skin soft, and serves as a powerful carrier and good for aromatherapy [4]. Basically, VCO is clean due to the separation of elements gradual chemical process with proper processing. VCO is tasteless and odor if the processing is correct. A high lauric acid content making VCO a product that can be used for many purposes, such as medical and beauty [5].

VCO is processed without processing heating, fermentation or administration of other chemicals. The quality of the oil produced is in the form of clear oil and results very good coconut oil. This rod is not pure yet or not clear in color. Therefore, the oil needs to be filtered again using a special oil filter with larger capacity made of aluminum. The results of this filter last filtered again with Whatman paper. To have a better product, it is needed filter machine that uses a filter or long vacuum machine [5].

Fats and oils consist of mixed triglycerides, which are esters of glycerol and long-chain fatty acids. Vegetable oils are found in fruits, nuts, seeds, plant roots and vegetables. Fat animal tissue is found throughout the body but the greatest amount is found in adipose tissue and bone marrow. Triglycerides can be solid or liquid, and this depends on fat composition. Most vegetable oils are in liquid form because it contains a number of unsaturated fatty acids, namely, oleic acid, linoleic, or linolenic acid with a low melting point. Animal fats is generally in solid at room temperature because it contains a lot of saturated fatty acids, for example palmitic and stearic acids which have a higher melting point [6].

Coconut oil

Coconut oil can be obtained from the flesh of fresh coconuts or from copra. The process for making coconut oil from the flesh of fresh coconuts is known as wet process because in this process water is added to extract oil. While the manufacture of coconut oil with materials of raw copra is known as the dry process [7].

Wet process

The origin of obtaining oil from coconuts is not from copra. Coconut meat is an easy ingredient to decompose due to the very high water content. In order to durable on the way, the coconut meat is dried with the intention to get copra. When the coconut meat is grated, the cells will be damaged and the contents of the cells easily dispensed in the white emulsion form with coconut milk [7].

Dry process

The simplest way to get oil from copra is by wrapping copra in cloth, then pounded using a pounder wood and then put in boiling water. The oil will float on the surface and can be separated from the water by taking the oil. Thus, only a small amount of oil is obtained. To increase the recovery oil, copra is given a pressure treatment [7]. The important (high) chemical content in a coconut are water, protein, and fat. These three compounds are a type of emulsion with protein as the emulsifier. Emulsions are liquids that form from mixtures two or more substances. Where the same substance exists separately smooth or evenly distributed in a substance that serves to tighten (strengthen) the emulsion. From these bonds, the protein will bind to the oil grains coconut with a thin layer so that the oil droplets will not get through joined together with water. The emulsion is not safe, it never breaks because there is still a smaller surface tension of the water protein than the oil protein. Coconut oil (VCO) can only come out if the emulsion bond is damaged. There are many ways to damage the emulsion, namely by centrifugation pickling, salting and enzymatic. Each of these ways has advantages and disadvantages. However, in general the technology is very applicable [8].

VCO is not rancid because the content of saturated fatty acids is higher so that the oxidation process is not easy to occur. If the quality of VCO is lower, then the bonding process will run faster. This is caused by the influence of oxygen, the presence of water and microbes that will reduce the fatty acid content in the VCO into other components. Physically, VCO must be clear in color. VCO has chemical characteristics which include, free fatty acids, the saponification number and the peroxide number [9].

Fats and Oils

Fats and oils are one of the groups included in the group. Lipids are organic compounds that are present in and insoluble in water but soluble in nonpolar organic solvents. Oil and fats are soluble in nonpolar organic solvents because they have the same polarity [10]. Oil is a chair material because it has one or more double bonds between the carbon atoms, so that it has a low melting point [11].

Fats and oil are compounds of triglycerides and glycerol. In its formation, glyceride is the result of the condensation of one molecule glycerol and three fatty acid molecules that make up one molecule triglycerides and one water molecule. Fats and oils are also ester compounds. Hydrolysis products are also carboxylic acids and glycerol. These carboxylic acids are also called fatty acids long and unbranched hydrocarbon chains [10].

Peroxide Number

The main product of lipid oxidation is hydrogen peroxide, which is common referred to as peroxides. Peroxides are organic compounds that do not stable form of triglycerides. Peroxide number is defined as the amount of peroxide content in every 1000 g of oil or fat. Unsaturated fatty acids can bind oxygen at their double bonds. Peroxides are formed and then aldehydes are formed. The greater the number value peroxide means the more peroxide present in the sample [12].

Numbers serve as an indicator of oil's quality even if they are not differentiating between the various unsaturated fatty acids. It undergoes oxidation and does not provide information on oxidative products. It can be stated that the peroxide number is an indicator of oil's basic oxidation level. Changes in peroxide value is an indicator of the basic level of oil oxidation. Peroxide value changes to time indicates the induction stage. Peroxide drops break down at a faster rate than the formation of low quality oil will have an induction period which is shorter [13].

Iodine number

Iodine number is also known as iodine value. Iodine number is a measure of the degree of unsaturation of an oil, fat, or wax; the amount of iodine, in grams, that is taken up by 100 grams of the oil, fat, or wax. Saturated oils, fats, and waxes take up no iodine, and therefore their iodine value is zero, but unsaturated oils, fats, and waxes take up iodine [14]. The number can express the degree of unsaturation of oil or grease. The greater the iodine number, the degree of deficiency is getting higher. Unsaturated fatty acids in oil and fat is able to absorb some of it and form a saturated compound [12].

Free Fatty Acid

Free fatty acids (FFA) are produced by the hydrolysis of oils and fats. Determination of FFA can be used as an indicator to determine quality of oil or fat. Free fatty acid (FFA) content analysis is crucial for assessing the quality of raw materials and how they will degrade during storage and the course of the shelf life of VCO. Additionally, the oxidation process may endow the oils with various qualities and sensory qualities [15].

Saponification Value

The number of milligrams of potassium hydroxide or sodium hydroxide needed to saponify one gram of fat is called as the saponification value or saponification number (SV or SN). It is a measurement of the average molecular weight (or chain length) of all fatty acids present as triglycerides in the sample. The smaller the average length of fatty acids, the lower the mean molecular weight of triglycerides, and vice versa, the higher the saponification value [16].

There are several methods in the production of VCO, as follows:

Fermentation methods

It was reported that the production of Virgin Coconut Oil mediating probiotic organism (*L. acidophilus*) by fermentation method

(both dry and wet methods) using computer control bioreactor and optimization of different parameters to obtain higher yields. The result showed that both the dry and wet methods were found to be suitable for the production of Virgin Coconut Oil. *L. acidophilus* used in induced fermentation is a probiotic organism which can efficiently involve in induced fermentation of coconut milk [17].

Another method using fermentation process was using 16S rRNA metagenomic sequencing to trace the transitions in microbial community profiles as coconut milk is fermented to release VCO in two VCO production lines. The results show that difference in the microbiome composition between the different processing steps was mainly due to the abundance of the *Leuconostoc genus* in the raw materials and its decline and transition into the lactic acid bacteria groups *Weissella, Enterococcus, Lactobacillus, Lactococcus,* and *Streptococcus* during the latter stages of fermentation. The result indicated that the dynamics of VCO fermentation depend on the shifts in abundances of various members of the *Lactobacillales order* [18].

Centrifugation Method

The use of tiny concentrations of chemicals helps the centrifugation technique, which has recently been established. The technique used is based on demulsifying coconut milk by rupturing the lipoprotein link in the emulsion. The benefit of the demulsification process is that it can shorten the production process and yield a higher yield of VCO while also lowering production costs. It was reported that Oil-in-water (O/W) coconut milk emulsion can be improved by centrifugation process with the aid of water soluble components in a very short amount of time. However, whether lipophilic or hydrophilic compounds are added, the quality of the coconut oil that is obtained by centrifugation is nearly identical. Improper raw material storage will have an impact on the yield's quality of coconut oil. Despite the fact that oil recovery for centrifugation using oil soluble material was higher, utilizing it is not recommended. This was because the lipophilic compounds, which had contaminated the VCO that was being recovered, would have adverse impacts on both the environment and consumer health [19].

Enzymatic Method

Protease enzyme serves as a supporting ingredient in the enzymatic technique of producing VCO, which also requires coconut milk as its primary ingredient. After the coconut emulsion is broken down by the enzyme, the VCO can be collected. Since the enzyme is a non-toxic substance, a catalyst for accelerating reactions, and active at low doses, enzymatic approaches have many benefits. Temperature, pH, and enzyme concentration all affect how quickly an enzyme reacts [20]. When the required outcomes have been obtained, the reaction is likewise readily stopped. Enzymes are classified as natural components that are environmentally friendly, which is another key factor in the use of enzymes in the generation of VOCs. The literature claims that bromelin enzyme, which is one of the protease enzymes, is found in pineapple. The recovery yield of virgin coconut oil (VCO) can be affected by a variety of processing techniques, including the enzymatic method employing crude protease extract (CPE) from overripe pineapple, microwave-assisted extraction (MAE), and ultrasound-assisted extraction (UAE). The enzymatic extraction method using pineapple might be helpful for the industrial production of VCO with a good oil yield [21].

CONCLUSION

VCO is a premium oil made from freshly harvested coconut flesh that is transparent as crystal and smells strongly of coconut. Medium Chain Fatty Acids (MCFA), especially Lauric Acid, are abundant in VCO. The high lauric acid concentration in VCO has many health benefits, including

boosting metabolism, preserving immunity, preventing cardiovascular disease and atherosclerosis, treating obesity, stress, cancer, and Alzheimer's disease, and acting as an antiviral and bacterial. The high amount of lauric acid in VCO has health benefits, including boosting metabolism, preserving immunity, preventing cardiovascular disease and atherosclerosis, treating Alzheimer's, cancer, obesity, and stress, as well as acting as an antiviral and bacterial. The main ingredient for making VCO is coconut, which contains water, protein and fat. These three compounds are a type of emulsion with protein as the emulsifier. Emulsifier is a substance that functions to strengthen or stabilize the emulsion. Coconut fruit protein will bind the coconut oil droplets with a thin layer so that the oil and water droplets do not combine. Oil will come out if the emulsion bond is broken. To destroy the emulsion on a household scale, centrifugation, fermentation and enzymatic methods can be done.

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

Daryit, FM., Dimzon, IKD., Valde, MF., Santos, JER., Garrovillas, MJM., and Villarino, BJ. (2011). Quality characteristics of virgin coconut oil: comparisons with refined coconut oil, Pure and Applied Chemistry, 839: 1789-1799.

Dayrit, FM. (2014). Lauric acid is a medium-chain fatty acid, coconut oil is a medium-chain triglyceride, Philippine Journal of Science, 1432: 157-166.

dd . Marina, A. M., Che Man, Y. B., Nazimah, S. A. H., & Amin, I., Chemical properties of virgin coconut oil. Journal of the American Oil Chemists' Society, 86: 301-307 (2009a).

??. Rohman A, Irnawati. 2019. Virgin Coconut Oil: Extraction, Physicochemical Properties, Biological Activities and Its Authentication Analysis. Food Reviews International 37(1):1-21

??. Marina, A. M.; Che Man, Y. B.; Ismail, A. Virgin Coconut Oil: Emerging Functional Food Oil. Trends Food Sci. Technol. 2009,20, 481–487.

??. Mansor, T. S. T.; Che Man, Y. B.; Shuhaimi, M.; Abdul Afiq, M. J.; Nurul, F. K. M. Physicochemical Properties of Virgin Coconut Oil Extracted from Different Processing Methods. Int. Food Res. J. 2012,19, 837–845

??. Narayanankutty, A.; Illam, S. P.; Raghavamenon, A. C. Health Impacts of Different Edible Oils Prepared from Coconut (Cocos nucifera): A Comprehensive Review. Trends Food Sci. Technol. 2018,80, 1–7.

??. D.D. Bawalan (2003). Production, utilization and marketing of virgin coconut oil, Coconut Information International, 10:17-19.

9. M.D. Fabian, E.M. Olivia, E.T. Chainani, I.M.S. de Vera, I.K.D. Dimzon, E.G. Gonazales and J. Elizabeth (2007). Essential quality parameters of commercial virgin coconut oil, Cord, 23:71-80.

10. Hernandez EM. 2013. Processing and nutritions of fat and oil. Wiley Blackwell.

慬 Abdel-Razek AG. Fats and oil: structures and functions. National Research Centre Egypt.

慬 Dia, V. P., Garcia, V. V., Mabesa, R. C., & Tecson-Mendoza, E. M., Comparative physicochemical characteristics of virgin coconut oil produced by different methods.

13. Tansakul, A. and Chaisawang, P. (2005). Thermophysical properties of coconut milk. J. Food Eng., pp: 73, 276 – 280.

14. Soeka Y S Sulistyo J and Naiola E 2008. Biochemical Analysis of Extracting Fermented Coconut Oil. BIODIVERSITAS 9(2). 91.

慬 Prapun R Cheetangdee N and Udomrati S 2016 Characterization of virgin coconut oil (VCO) recovered by different techniques and fruit maturities International Food Research Journal 23(5) 2117.

慬 Monera, O.D. and del Rosario, E.J. (1982). Physico-chemical evaluation of the natural stability of coconut milk emulsion. Ann. Trop. Res., pp: 4, 47 – 54.

17. Satheesh N, Prasad N. Induced fermentative production of virgin coconut oil. As. J. Food Ag-Ind. 2012, 5(05), 355-363

憬 Maini ZA, Lopez ZM. 2022. Transitions in bacterial communities across two fermentation-based virgin coconut oil production processes. Heliyon, 1-13.
19. Abdurahman, N.H., Mohammed, F.S., Yunus, R.M. and Aman, A. (2009). Demulsification of Virgin Coconut Oil by Centrifugation Method: A Feasibility Study. International Journal of Chemical Technology, pp: 1(2), 59-64.
20. Nadzirah K Z Zainal S Noriham A Normah I and Siti Roha A M 2012 Physico-Chemical Properties of Pineapple Crown Extract Variety N36 and Bromelain Activity in Different Forms APCBEE Procedia 4(2012) 130 – 134.
21. Kumaunang M and Kamu V 2011. Activities of Bromelin Enzymes of Extracts Pineapple Skin (Anenas Comosus) Jurnal Ilmiah Sains 11(2) 198.

How to cite this article: Miftahul Khairati. Virgin coconut oil: a review. *International Journal of Research and Review*. 2023; 10(6): 70-75.
DOI: *https://doi.org/10.52403/ijrr.20230610*

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