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An Overview of Factors that Affected in Quality of Virgin Coconut Oil

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Abstract. There were some factors that affected of virgin coconut oil (VCO) quality. There was a raw material condition, the process to make VCO, packaging of VCO, and storage condition. For raw material condition, some differences in the chemical and quality properties of VCOs produced using different coconut varieties. This variety affects the iodine value and the fatty acid composition of the VCO samples. In saponification value, free fatty acids (FFA), peroxide value, and moisture content, the variety of coconut used did not affect. Phenolic contents of VCO also vary with the endosperm composition of coconut. There were many methods to produce VCO. Even if the whole process is different from one another, VCO did not differ significantly from each one and meets the standards. The fresh-dry method obtained the highest oil recovery, but the fermentation method resulted in a superior VCO quality. Among the packaging material studied, the best protection against VCO oxidation was provided by metallic polyester and high-density polyethylene (HDPE). The heat has significantly reduced the stability of VCO for storage condition. This paper aims to describe factors that affect quality in the virgin coconut oil.

INTRODUCTION

Coconut oil is a *Cocos nucifera* kernel vegetable oil. Commercial refined coconut oil (RCO) is extracted from dried copra and the subsequent unrefined oil is processed on an industrial scale through washing, bleaching, and deodorization [1]. Made from mature fresh coconut meat, the virgin coconut oil (VCO) is obtained and handled using only physical or natural methods [2] and with or without heat use and without chemical refining [3-4].

The international standards for coconut oil were set by two organizations, the Codex Alimentarius and the Asian and Pacific Coconut Community (APCC). The current Codex Standard for Coconut Oil states that edible vegetable oils can be refined through the extraction and washing of alkaline, bleaching and deodorization to remove undesired components and extend shelf life [2] based on commercially refined, bleached and deodorized coconut oil (RBDCO).

Codex offers a general definition of "virgin oils," which states that these oils should be suitable in a natural state for human consumption and can only be purified with water-washing, settling, filters and centrifugation. The APCC issued an interim standard for VCO in response to the specific needs of coconut producers. It should be noted that while APCC provides a definition similar to Codex, it has an additional condition that VCO may be produced by "natural means" as long as it does not alter the oil [5].

Unrefined oil is gaining great interest as a result of consumer interest in natural and safe food products [6]. The consumption of natural and chemical oils – free edible oils – is now demanding [7]. Studies from the early 1900s have been carried out on the problem of the rancidity of coconut oil. The quality of the oil was affected considerably by molds, air and light [8]. In samples, high levels of acidity, air and light exposure, fat-soluble enzymes were obtained under conditions of high humidity [9]. The other found that rancidity is due to air exposure, although coconut oil is still found to have stabilized higher in unsaturated fatty acids than other vegetable oils [10-11]. The deterioration of vegetable oils can occur due to chemical hydrolysis, chemical oxidation and/or microbial action which can be promoted by enzymes, metals, heat, light and air. However, the

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presence of minor components or additives in the oil, such as phenols, can increase the stability of the oil [12-13].

The quality of VCO is based on many factors relating to the condition of the raw material, processing method, packaging and storage condition. There have been many studies of these factors. The purpose of this paper is to describe quality factors in virgin coconut oil.

RAW MATERIALS

Study with two variety of coconut, Laguna Tall (LT) and Catigan Green Dwarf (CGD) and hybrid was done. This result showed that variety affects the VCO iodine value. But the variety of coconuts used was not affected by saponification (SV), free fatty acid (FFA), peroxide value (PV) and moisture content. The fatty acid composition of the VCO samples differs in the different coconut cultivars. Lauric acid, still the main fatty acid of coconut oil. The highest palmitic acid content in VCO made from Laguna Tall variety and VCO made from Catigan Green Dwarf's had the highest stearic and oleic acid content [14-15].

Other studies were conducted in the form of coconut milk preparation and compared with different components of coconut endosperm, namely white coconut kernel, white coconut kernel and coconut testa, white coconut kernel and coconut water, and white coconut kernel, coconut testa and coconut water. This result suggested that the final phenolic content of coconut oil depends on the endosperm. In the endosperm composition, phenolic content also varies [16].

The composition of wet coconut testa and copra testa oils was evaluated from the other research and compared with whole wet coconut, whole copra, wet white coconut kernel and white copra kernel. The study showed that the fat samples ranged between 34 and 63%. The copra testa content of lauric acid was 32.4% and 40.9%, while the other oils accounted for 50-53%. The author also reported the richness of testa oil in monounsaturates and polyunsaturates compared to other coconut oil samples. These research findings had shown that coconut testa oil contains more natural antioxidants like tocopherols, tocotrienols and phenolics than coconut kernel oil and could be beneficial to health [17].

PROCESSING METHODS

The physicochemical characteristics of various methods produced by VCO have been determined. A dry method, the incubation method for wet coconut-milk-40°C and wet-coconut milk-freeze- and thawing. The findings have shown that the yield, fatty acid and humidity of the VCOs of the three processing methods have not been significantly differing. Important differences for iodine value between some VCOs [15].

Other studies using different processing methods revealed that physicochemical analyzes were conducted on all VCOs together with the APCC standards. The result showed that the lowest iodine value was received from the chilling and thawing method and the highest from the fermentation method. Fresh-dry methods were the highest FFA for both methods, while in the fermentation method, the lowest FFA was recorded. Enzyme followed by fresh–dry, chilling and thawing was the highest saponification value and the lowest was a fermentation method. This author mentioned that fresh-dry method had the lowest moisture content, and chilling and thawing and enzymatic methods were the highest. The fresh-dry method also provided the highest viscosity and closely followed the chilling and thawing method, enzymes and fermentation methods. Fermentation was followed by a fresh-dry, chilling and enzyme methods, which produced the highest lauric acid [18].

The other research to determined phenolic substance showed that coconut oil hot extraction (HECO) was richer in phenolic substances compared to coconut oil cold extraction (CECO). The result also showed that HECO's phenolic extracts' antioxidant activity was superior to CECO's. This means that at any given total phenol concentration the phenolic extracts of HECO display higher antioxidant capacities than those of CECO. HECO's more complex phenolic composition should be associated with this higher antioxidant capacity of HECO's phenolic extracts. There was no significant difference between CECO and HECO's fatty acid content, acid values, and peroxide values [16]. Coconut oil has much better thermal stability and oxidative stability compared to several other edible oils due to a high percentage of saturated fatty acids [19].

PACKAGING

Srivastava *et al*. [20] investigated the storage stability for hot and cold extracted virgin coconut oil in several flexible and rigid packing systems. The study showed that CEVCO and HEVCO increased acidification of the virgin coconut oil and oxidative rancidity after 12 months of storage. As the expiry date approaches, the level of unsaturation tends to decline, while fatty acid percentages were still constant for a maximum period of 12 months. It is clear that the two oils were stable and acceptable. The authors report that VCO's quality was significantly affecting packaging material's ability to eliminate light and oxygen that oxidative changes further delayed. Metallic Polyester (MP) and high-density polyethylene (HDPE) packaging systems were high resistance to transmission of oxygen in comparison to the other flexible (LLDPE and LDPE) and rigid container (PET). Consequently, peroxides in MP and HDPE packaging system were slowed down in both CEVCO and HEVCO. In addition, the authors also determined that MP and HDPE protected best against oxidation.

STORAGE

Research to determine the best extraction of VCO from three methods of extraction, such as extraction with the press, extraction with the addition of yeast and extraction with the addition of oil and influence of temperature during storage was done. Each sample counted 50 g packed into dark glass bottles and closed tidely. Each sample was kept in an incubator with a temperature of 25 °C, 30 °C and 45 °C and storage will be done for 70 days. The result showed that VCO which is extracted with the addition of yeast and was kept at 30 °C had the best quality compared to the standard [21].

The stability of the storage was investigated in virgin coconut oil and extra virgin olive oil during thermal treatment. VCO heated at 190 °C for 40 days storage compared to extra virgin olive oil (EVOO). Changes in the composition of fatty acid have been identified throughout the study period. The findings have shown that heat significantly reduces the stability of VCO and EVOO. The results of GC showed significant changes in linolenic and palmitic acid percentages when stored in EVOO. Increased stability in VCO was found as it includes higher saturated fatty acids. FTIR showed that over 40 days of storage both oils were oxidized and hydroperoxide-produced, but that the VCO oxidation had been reduced. Meanwhile, in both the oils a considerably decreased iodine value and the total phenolic content decreased, as opposed to a percentage decrease in the total phenolic content, iodine value was higher in VCO compared to EVOO [22].

SUMMARY

Variety of coconut affect the iodine value of the VCO but did not affect in saponification value, free fatty acids (FFA), peroxide value and moisture content also the fatty acid composition of the VCO. Phenolic contents vary with the composition of the endosperm of coconut. VCO processing methods did not vary greatly from each other and conformed to the standards given. The fermentation method resulted in a superior quality of VCO if compared from other processing methods. With metallized polyester and high-density polyethylene for packaging material provided the best protection towards oxidation of VCO. For storage condition, the temperature has significantly decreased the quality stability of VCO.

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