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*by* I D Kumalasari , I Santosa, E Sulistiawati Coconut Oil Production With  
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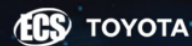
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## Coconut Oil Production with Various Roasting Temperatures and Dried Grated Coconut as A By-Product

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**Abstract.** Coconut meat used as raw material for making coconut oil. The purpose of this study was to evaluate the physical and chemical quality of coconut oil and dried coconut meat with various age of coconut fruits as a by-product of pressing roasted coconut with various temperatures. Oil from coconut meats were obtained by heated to 70 °C, 80 °C, 90 °C, 100 °C, 110°C for 100 min then pressed and filtered. Dried coconut meat from pressed coconut meats that has been roasted with various temperatures then analyzed its physico-chemical properties and nutritional value. The results showed that the mature of coconut meat with roasting temperatures of 90 °C has white color of flour. Proximate testing shows that the roasting temperature of 90 °C has the highest carbohydrate (17.93%), mineral (3.53%) and fiber content (43.74%). While coconut meats roasted with 80 °C has higher levels of protein (29.03%) and fat (51.53%). Nutritional values such as water content, ash, protein, mineral and fat content showed that the best treatment is roasting with temperature 90 °C for 100 minutes. The conclusion of this study, the rate of optimum temperature for coconut oil extraction are 80 °C - 90 °C and the best nutritional value of dried coconut flour as by-products also at that temperature. Desiccated coconut potentially developed into wide range of high value products because has high nutritional value, especially dietary fiber and protein.

**Keywords:** Coconut Meat, Coconut Oil, By Products, Temperature, Nutrition

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### 1. Introduction

Coconut (*Cocos nucifera* L.) is monocotyledon palm from the Palmaceae family [1]. Coconut has been reported to be among the most importantly and extensively grown in the world [2]. Coconut is also known to be commercially viable as a result of its nutritional uses [3]. Coconut is rich in fiber, vitamins, and minerals. It provides many health benefits beyond its nutritional content. Coconut not contain gluten with health promoting fiber and important nutrients. Coconut meat can be further processed to produce two high-value products, Virgin Coconut Oil (VCO) and dried coconut meat (DCM). DCM actually a by-product made during the coconut oil making process. DCM is extremely high in fiber. It also provides a good source of protein and can improve digestion, help regulate blood sugar, protect against diabetes, help prevent heart disease and cancer, and aid in weight loss [4].

Virgin Coconut Oil (VCO) is one of the edible oil growing in popularity as a nutritional supplements and functional food in the emerging functional food market [5]. VCO is oil derived from the fresh and mature kernel (12 months old). VCO extracted from fresh and mature kernel of the



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coconut by natural and mechanical technique with or without of heat [6]. Various methods like Solvent extraction method, dry method and wet methods are available for extraction of coconut oil from coconut kernel [7].

Production of VCO with a dry process usually uses a fairly high heating temperature (100 °C-120 °C). High temperature makes some nutritional components will decrease. The by-product of VCO extraction in the form of dried grated coconut is not yet known the quality with different temperatures during the VCO extraction process. This studies objectives to investigate the effective processes for increase the quality of VCO, DCM as functional food with various age of coconut fruit.

## 2. Methods

### 2.1. Raw Materials and Extraction of VCO

Coconut meat were selected by different of fruits age. Only coconuts which had not sprouted were selected. Young coconut meat, mature/medium coconut meats and old coconut meat were obtained from local markets in Giwangan market, Yogyakarta in Indonesia. All samples were grated and dried by roasting methods with various temperature (70 oC, 80 oC, 90 oC, 100 oC). Then, the dried grated coconut meat was pressed to produce the coconut oil. The dessicated coconut meats as by-product from coconut oil extraction were evaluated of total fraction from VCO with various temperature for extraction, nutritional and physico-chemistry properties.

### 2.2. Total fraction of Fatty Acid (FA) GC-MS

Analysis of FA was performed on a GC MS QP 2010 by Shimadzu equipped with a split/split less injector. Separations were achieved using a fused silica Zebtron ZB FFAP capillary column (60 m × 0.25 mm ID, 0.25 Km film thickness). Helium was used as the carrier gas at flow rates of 1.99 mL/min and a split ratio of 1:10. The injector temperature was 280°C. The oven temperature was programmed at 100°C.

Lab Solution software was used to control the operation of GCMS. MS spectra were obtained at range width m/z 40 500, interface temperature 300°C, ion source temperature 210°C, solvent cut time 2 min, event time 0.30, and scan speed 1666. peaks of FA were identified by comparing their retention time and equivalent chain length with respect to standard FA from Supelco Inc., Bellefonte, PA (Supelco 37 Component FA Mix) and other reagents from Merck, Germany. All determinations were carried out in triplicates.

### 2.3. Determination of nutritional and physicochemical properties

The proximate components of coconut flour (fiber, moisture, protein, carbohydrates, lipid, ash and dry matter) were determined using the method of AOAC [8]. The coconut colour from all samples were observed to determine the best quality of coconut flour as by product from VCO production with different temperature for dry treatment.

### 2.4. Data analysis

In this study all physico-chemical measurements of the VCO have been performed in triplicate. All results are presented as the average value of the measurements.

## 3. Results and Discussion

### 3.1. Physical properties of VCO and dried coconut meat

Physical properties of coconut oil was evaluated and the result showed in Table 1. The extraction with 70°C, 80 °C and 90°C produces VCO without colour (clear) but extraction treatment with 100 °C temperature produces VCO with no clear liquid. High temperature can damage oil components causing unclear color [9].

Dried coconut meat with various age showed the different colour after treated with different temperatures on VCO extraction (Table 1.). Young dried coconut meat showed white yellow color after treated with 70°C, 80 °C, 90°C and little bit brown with 100 °C temperature. This results similar on mature dried coconut meat with 70°C, 80 °C, 90°C and 100 °C. Table 1. showed the old dried coconut meat colour are dominantly brown.

**Table 1.** Physical properties of dried coconut meat with various age showed the different colour after treated with different temperatures

Temperature (°C)	VCO Colour	Dried Coconut Meat		
		Young	Medium/Mature	Old
70	Clear	White yellow	Yellow brown	Dark brown
80	Clear	White yellow	White brown	Brown
90	Clear	White yellow	White brown	Brown
100	Unclear	Yellow brown	White yellow	Brown

Coconut flour has a cream color and is less white than all-purpose flour. It has less coconut flavor (almost bland taste) due to reduced fat content.

### 3.2. Total fractions of virgin coconut oil (VCO)

Total fraction from three of samples (VCO) with different temperature treatments were evaluated by GC-MS. The results showed that the increasing temperature of grated coconut roasting, the number of fatty acid fractions also increased (Table 2). The results also showed that the more mature the coconut fruit is directly proportional to the number of fatty acid fractions.

**Table 2.** Total Fractions of VCO

Temperature (°C)	Total fractions of VCO		
	Young	Medium/Mature	Old
70	10	17	28
80	15	25	50
90	20	68	60
100	50	75	140

### 3.3 Nutritional and physicochemical properties.

Composition of coconut flour depends on the retention of components after the extraction of coconut milk or oil from desiccated coconut. Table 3 presented that the composition of DCM produced by dry methods. Dry process involves drying of grinded coconut meat, oil extraction and pulverizing the meal. The result showed that the process produces a high protein DCM (29.03 %) in DCM with 80 °C heat treatment on mature/medium kernel which can be used as wheat substitute. The dry process produces high protein DCM which can be used in the preparation of baked products

The amount of moisture (0% - 0.8 %) was very low in DCM especially on mature/medium coconut meat and old coconut meat thereby showing a very high amount of dry mater (Table 3.). The presence of moisture shows the plant material will deteriorate with time when stored in its fresh form because moisture could encourage certain microbial activities and reduce the quality of DCM [10].

The results (Table 3.) showed that the amount of carbohydrates in young DCM with various temperature treatment were higher (30%-34%) than mature DCM and old DCM. This shows that young *Cocos nucifera* nut is a better source of carbohydrates than mature or old of DCM. Carbohydrates play essential role by providing energy and nourishment to animals. However, the result shows it is also a good source of lipids and proteins.

**Table 3.** The proximate components of coconut flour

Nutrition content	Temperature (°C)	Coconut meat (kernel) nutrition (%)		
		Young	Medium/Mature	Old
Moisture	70	3	0	0.60
	80	1.40	0.40	0.80
	90	1.80	0.40	0.80
	100	1.60	0.20	0.20
Carbohydrate	70	30.12	12.22	11.73
	80	34.22	14.26	12.25
	90	33.60	17.93	12.22
	100	31.11	18.76	13.52
Protein	70	5.70	27.87	25.05
	80	6.84	29.03	19.69
	90	11.06	25.05	23.37
	100	12.14	20.10	16.82
Lipid	70	50.81	63.90	56.74
	80	49.91	51.53	56.48
	90	50.90	50.56	66.42
	100	50.88	50.14	53.79
Ash	70	5.11	3.76	4.56
	80	4.59	3.00	3.69
	90	4.60	3.53	3.65
	100	4.62	3.61	3.89
Fiber	70	46.59	32.49	43.18
	80	43.96	39.18	49.37
	90	42.91	43.73	41.12
	100	42.94	43.76	38.97

The results showed high percentage (50%-66%) of lipid in all age of DCM especially on old DCM with 90 °C temperature treatment. The high lipid content also shows that coconut could be important for the synthesis of certain hormones of lipid origin and could also help in proper utilization of some fat-soluble vitamins. The high amounts of lipids and carbohydrates confirms coconut in nutrition contributes as a good source of ATP for control many important biological processes [11]. This high amount of lipid and carbohydrates shows coconut can play a vital role for the sustenance human life.

Non-digestible carbohydrate is composed of fiber and passes through the gastrointestinal tract without being broken down or absorbed and is passed out of the body. The fiber content promotes for health. Coconut flour has been found in several studies to have a Glycemic Index (GI) lowering effect, because coconut meat has a simple carbohydrate content coupled with a high fiber, it yields a flour that is less disruptive to blood sugar levels [12].

The results showed Coconut flour is a good source of protein (5%-29%) from all age of coconut nuts. The highest protein percentage is mature/medium DCM with 80 °C heat treatment (29.03%). This result similar with previous research [10]. It has functional properties as of wheat flour (gluten)

but gluten free. This is an advantage for a growing percentage of the population, who has allergic reaction to gluten [13]. The amount of ash was the lowest among the proximate parameters evaluated. It reveals the corresponding amount of mineral elements in coconut. Although mineral elements do not yield energy but they are essential for the proper functioning of human immune system and for sustaining life [14]. Consumption of food materials rich in minerals aid in supplying the individual mineral elements that may help boost the immune system and sustain life.

The coconut flour from this research contains 32% - 49 % dietary fiber which can be used as a functional ingredient. The old DCM with 80 °C heat treatment has highest percentage of total fiber (49.4 %). The organic virgin coconut flour is similar in texture to wheat flour but offers more fiber than wheat bran. It is vegan, low carb flour and gluten free. It is ideal for baked foods. The utilization of coconut flour as a functional food will solve the problem of chronic diseases and also encourage the industry and farmers to produce added value or healthful products from coconut flour. This will increase the production and promotion of the coconut industry.

#### 4. Conclusions

Desiccated coconut potentially developed into wide range of high value products because has high nutritional value, especially dietary fiber and protein. This will increase the production and promotion of the coconut industry.

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#### References

- [1] J.G. Ohler, 1999. Modern coconut management: Palm cultivation and products. Rome: Intermediate Technology Publications.
- [2] A.K. Onifade, and Y.A. Jeff-Agboola, 2003. Effect of fungal infection on proximate nutrient composition of coconut (*Cocos nucifera* Linn) fruit. *Food Agric. Environ.*, 1: 141-142.
- [3] I.E. Akubugwo, G.C. Chinyere and A.E. Ugbo, 2008. Comparative studies on oils from some common plant seeds in Nigeria. *Pak. J. Nutr.*, 7: 570-573.
- [4] R. Lalitha. 2014. Coconut Flour -A Low Carbohydrate, Gluten Free Floura Review Article. *International Journal of Ayurvedic and Herbal Medicine* 4 (1) 1426-1436.
- [5] Marina AM, Che Man YB, Amin I (2009) Virgin coconut oil: emerging functional food oil. *Trends in Food Science and Technology* 20 (10): 481-487
- [6] Mansor TST, Che Man YB, Shuhaimi M, Abdul Afiq MJ, d Ku Nurul FKM (2012) physicochemical properties of virgin coconut oil extracted from different processing methods. *International Food Research Journal* 19 (3): 837 -845.
- [7] N. A. A. Ghani, A. A. Channip, P. C. H. Hwa, F Ja'afar, H. M. Yasin and A. Usman. 2018. Physicochemical properties, antioxidant capacities, and metal contents of virgin coconut oil produced by wet and dry processes. *Food Science and Nutrition* 6 (5): 1298-1306.
- [8] AOAC., 2010. Official Methods of Proximate Analysis. AOAC International, Gaithersburg, MD., pp: 15.
- [9] Patil, U., Benjakul, S., Prodpran, T., Senphan, T., & Cheetangdee, N. (2016). Characteristics and quality of virgin coconut oil as influenced by maturity stages. *Carpathian Journal of Food Science and Technology*, 8(4), 103–15.
- [10] L.L.W.C. Yalegama, D.N. Karunaratne., R. Sivakanesan., C. Jayasekara. 2013. Chemical And Functional Properties Of Fibre Concentrates Obtained From By Product Of Coconut Kernel. *Food Chemistry*. 141. 124-130
- [11] H.O. Edeoga., D.E. Okwu and B.O. Mbaebie, 2005. Phytochemical constituents of some Nigerian medicinal plants. *Afr. J. Biotech.*, 4: 685-688.

- [12] A. Narayanankutty., S.P. Illam., A.C Raghavamenon. 2018. Health impacts of different edible oils prepared from coconut (*Cocos nucifera*): A comprehensive review. *Trend in Food Science & Technology*.
- [13] U. Patil & S.Benjakul. 2017. Characteristics of albumin and globulin from coconut meat and their role in emulsion stability without and with proteolysis. *Food Hydrocolloids*, 69, 220–8.
- [14] K.O Soetan., C.O. Olaiya and O.E. Oyewole, 2010. The importance of mineral elements for humans, domestic animals and plants: A review. *Afr. J. Food Sci.*, 4: 200-222.



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