

**PRODUCTION OF VIRGIN COCONUT OIL VIA CENTRIFUGATION AND  
OVEN METHODS**

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of the requirements for the award of the degree of  
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I declare that this thesis entitled “Production of virgin coconut oil via centrifuge and oven methods” is the result of my own research except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.”

Signature :.....

Name : Mohamad Fariz Bin Ahmad

Date :

*Special Dedication to my family members,  
my friends, my fellow colleague  
and all faculty members*

*For all your care, support and believe in me.*

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## ABSTRACT

The conventional ways of breaking emulsions using heat is disadvantageous from the both economic and environmental perspectives. In this study, the production of virgin coconut oil from coconut oil milk was investigated. Centrifugation and hot method were used for separation of oil. Analysis was carried out by gas chromatography. Results show that, production of virgin coconut oil increases with increasing centrifugal speed. The optimum temperature required to maintain the nutrition oil oil was found to be 60oC. Experimental data also presented to show the influence of Triton -X-100, Tween 20 and SDDS on stability of virgin coconut oil emulsion.

## **ABSTRAK**

Penggunaan cara lama untuk membaurkan emulsi dengan menggunakan haba adalah sesuatu kerugian dari segi ekonomi dan persekitaran khususnya. Dalam kajian ini, penghasilan minyak kelapa dara melalui santan kelapa dikaji. Kaedah emparan dan penggunaan haba digunakan untuk penghasilan minyak, Analisis minyak dilakukan dengan penggunaan alat kromatografi gas. Hasil ujikaji ini menunjukkan bahawa; penghasilan minyak kelapa dara adalah tinggi apabila halaju emparan tinggi. Suhu yang optimum diperlukan untuk mengekalkan nutrisi minyak yang terhasil. Data ujikaji juga memperlihatkan kesan agen pembauran seperti Triton-X-100, Tween 20 dan SDDS terhadap kestabilan emulsi minyak kelapa dara.

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**LIST OF SYMBOLS/ABBREVIATIONS**

g	-	acceleration due to gravity (9.81 m/s <sup>2</sup> )
h	-	travel distance of droplet (m)
Min	-	minutes
mL	-	mililiter
mm	-	milimeter
r		water density (kg/m <sup>3</sup> )
r <sup>0</sup>		oil density (kg/m <sup>3</sup> )
v	-	terminal velocity of droplet (m/s),
VCO	-	virgin coconut oil
w/v	-	weight per volume
w/w	-	weight per weight
y		viscosity of the continuous phase (pa·s)
%	-	percentage
°C	-	degree Celsius
°F	-	degree Fahrenheit

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of the research.

Virgin coconut oil or VCO is directly extracted from fresh coconut flesh and it different between coconut oil in term of nutrient composition and method of production. Virgin coconut oil belongs to a group of vegetable oils abundant in lauric acid (Hui, 1996). German and Dillard (2004) cited the virtues of Lauric acid of having antiviral, antibacterial, anticaries, antiplaque and antiprotozoal functions. The Philippine National Standards or PNS (Bureau of Product Standards (BPS), 2004) defines VCO as the oil obtained from the fresh, mature kernel of the coconut by mechanical or natural means, with or without the use of heat, without undergoing chemical refining, bleaching or deodorizing, and which does not lead to the alteration of the nature of the oil. Aside from Lauric acid, VCO contains a considerable amount of short-chain fatty acids such as capric, caproic and caprylic which were also investigated to have antimicrobial and antiviral effects (Bergsson, Arnfinnsson, Karlsson, SteingriOMsson, & Thormar, 1998; German & Dillard, 2004; Van Immerseelet al., 2004). VCO has been claimed to have numerous beneficial health effects (Delmo, 2004; Villariba, 2003, 2004). Nevin and Rajamohan (2004) reported that VCO lowered total cholesterol, triglycerides, phospholipids, LDL, and VLDL cholesterol levels and increased HDL cholesterol in serum and tissue. Lauric acid makes up nearly 50% of the medium chain fatty acid (MCFA). Published studies showed that virgin coconut medium chain fatty acids

(MCFA) that mimic those of mother's breast milk can boost the infant immune system, and also cause adult metabolic rate increase as VCO is converted directly to energy in the liver, passing through intestinal portal veins. Other benefits of virgin coconut oil include increasing the rate of recuperation and therapeutic application; such as antioxidants, antimicrobials, anodynes and vulneraries. The new cells produced help increase metabolism and faster the rate of damaged cell replacement.

The price of virgin coconut oil in the international market is in the range of USD 10 – 15 per liter. Virgin coconut oil is more valuable in terms of profit than coconut oil because of the health effect and besides that the raw material (coconut) is easy to get and cheap and also makes this field more interesting.

### 1.1.1 Benefit of virgin coconut oil:

- Kills viruses that cause influenza, herpes, measles, hepatitis C, SARS, AIDS, and other illnesses.
- Kills bacteria that cause ulcers, throat infections, urinary tract infections, gum disease and cavities, pneumonia, and gonorrhea, and other diseases.
- Kills fungi and yeasts that cause candidiasis, ringworm, athlete's foot, thrush, diaper rash, and other infections.
- Expels or kills tapeworms, lice, giardia, and other parasites.
- Provides a nutritional source of quick energy.
- Boosts energy and endurance, enhancing physical and athletic performance.
- Improves digestion and absorption of other nutrients including vitamins, minerals, and amino acids.
- Improves insulin secretion and utilization of blood glucose.
- Relieves stress on pancreas and enzyme systems of the body.
- Reduces symptoms associated with pancreatitis.
- Helps relieve symptoms and reduce health risks associated with diabetes.
- Reduces problems associated with malabsorption<sup>1</sup> syndrome and cystic fibrosis.
- Improves calcium and magnesium absorption and supports the development of strong bones and teeth.
- Helps protect against osteoporosis.
- Helps relieve symptoms associated with gallbladder disease.
- Relieves symptoms associated with Crohn's disease<sup>2</sup>, ulcerative colitis, and stomach ulcers.

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<sup>1</sup> Malabsorption is a state arising from abnormality in digestion or absorption of food nutrients across the gastrointestinal (GI) tract.

<sup>2</sup> Crohn's disease (also known as regional enteritis) is an autoimmune disease, which can



- Improves digestion and bowel function.
- Relieves pain and irritation caused by hemorrhoids.
- Reduces inflammation.
- Supports tissue healing and repair.
- Supports and aids immune system function.
- Helps protect the body from breast, colon, and other cancers.
- Is heart healthy; improves cholesterol ratio reducing risk of heart disease.
- Protects arteries from injury that causes atherosclerosis and thus protects against heart disease.
- Helps prevent periodontal disease and tooth decay.
- Functions as a protective antioxidant.
- Helps to protect the body from harmful free radicals that promote premature aging and degenerative disease.
- Does not deplete the body's antioxidant reserves like other oils do.
- Improves utilization of essential fatty acids and protects them from oxidation.
- Helps relieve symptoms associated with chronic fatigue syndrome.
- Relieves symptoms associated with benign prostatic hyperplasia (prostate enlargement).
- Reduces epileptic seizures<sup>3</sup>.
- Helps protect against kidney disease and bladder infections.
- Dissolves kidney stones.
- Helps prevent liver disease.
- Is lower in calories than all other fats.
- Supports thyroid function.
- Promotes loss of excess weight by increasing metabolic rate.
- Is utilized by the body to produce energy in preference to being stored as body fat like other dietary fats.
- Helps prevent obesity and overweight problems.

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affect any part of the gastrointestinal tract from mouth to anus; as a result, the symptoms of Crohn's disease vary among afflicted individuals

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<sup>3</sup> An epileptic seizure is caused by twitching excessive and/or hypersynchronous electrical neuronal activity, and is usually self-limiting

1. 1.2 Virgin Coconut Oil can be produced by two common methods:

1.3.1 Heated (Hot Methods) processes.

Hot methods apply extreme pressure or high heat to extract the oil from the nut.

1.3.2 Non-Heated (Cold Methods) processes.

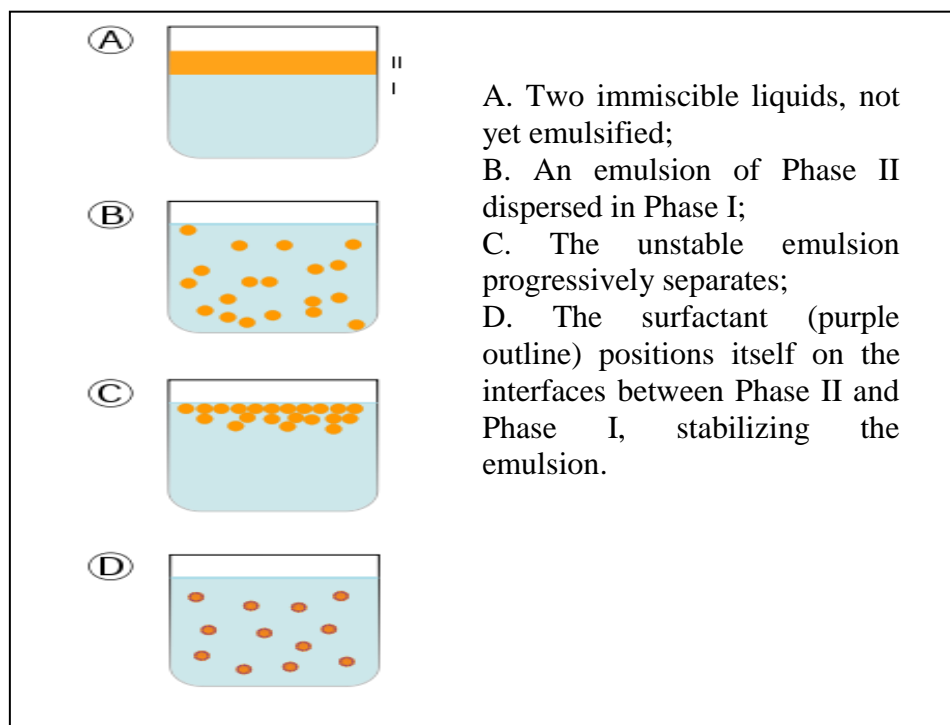
Cold methods obtain oil without applying heat or pressing the coconut meat mechanically, hence the more common term "cold pressed".

### 1.1.3 Production of virgin coconut oil by centrifugation method (Separation process-cold method)

Centrifuged Coconut Oil is made from fresh coconuts opened less than 48 hours after they are picked from the trees. They first shell the coconuts and then chop the flesh, placing it in an expeller press. The temperatures of the coconut flesh and the resulting coconut milk emulsion do not exceed 25° C or 78.8° F (room temperature). Once the coconut is shelled, it takes less than 45 minutes to produce the milk. The resulting coconut milk emulsion is then chilled slightly to 10° C (50° F) so that the oil will “pull out of solution.” In other words, the chilling helps to break the protein emulsion that holds the oils in solution. Next, the cooled milk, by use of a large centrifuge, is separated into the pure oil that we sell here and a “skim” coconut milk. This method of extraction requires no heat at all. It works like a cream separator that is used for separating cream from cow’s milk. It requires quite a few passes through this chilled centrifuge to obtain pure oil, but the resulting oil is absolutely fabulous. Cold processed virgin coconut oil allows the retention of monoglycerides and other natural anti-oxidants such as tocopherol (vitamin E), vitamin A and C which serves as natural preservatives. Heating will destroy these substances leaving only the lauric acid to work alone rather than in conjunction with these micro-nutrients.

#### 1.1.4 Production of virgin coconut oil by oven method (Emulsion-hot method)

Production of virgin coconut oil by oven must be in control especially the temperature because we need to maintain the nutrient inside the virgin coconut oil and the nutrient will be destroyed by high temperature. An emulsion is a mixture of two immiscible (unblendable) substances. One substance (the dispersed phase) is dispersed in the other (the continuous phase). Emulsion is also a term used in the oil field as untreated well production that consists primarily of crude oil and water. Eighty percent of the oilfield emulsion produced is the type of water-in-oil (*w/o*) emulsion (Lixin at al., 2003). Water/oil/solid emulsions are mixture of ordinarily incompatible materials. The concept of microwave demulsification was first introduced by Klaila (1983) and Wolf (1986) in their patent applications. Authors Chih and Yeong (2002), Fang *et al.* (1989) and Fang and Lai (1995) reported demulsification of water-in-oil (*w/o*) emulsions by microwave radiation. By using microwave method more efficient separation process can be achieved



**Figure 1.0:** Emulsification process

## 1.2 Identification of problem.

Once mistakenly believed to be bad for the heart because of its saturated fat content, virgin coconut oil is now known to contain a unique form of saturated fat that actually helps prevent heart disease, stroke, and hardening of the arteries as well as provide many other health benefits. Asian and Polynesian people who rely on coconut and virgin coconut oil as a part of their daily diet have the lowest heart disease rates in the world. Some of these people get as much as 50 percent of their total daily calories as saturated fat, primarily from virgin coconut oil. If virgin coconut oil caused heart disease, as some people used to believe, these people would have all died off centuries ago. Those populations who consume large quantities of coconut oil have remarkably good cardiovascular health. Absent are the heart attacks and strokes characteristic in Western countries where coconut oil is rarely used.

Furthermore with all the miracle cures and special diets around us, we should be getting more slender and healthy by the minute. But notice people in your local supermarkets and restaurants today and decide for yourself whether that appears to be true. After a three-decade run as the national obsession, dieting to become slim by eating less fat or skipping meals simply has not worked. The only things really getting thinner are our wallets. We have been taught that fat and oil are bad for our health because they clog our arteries, make us fat, and have us falling apart in no time. For the past few decades, the official story has been that the dreaded killers have been the saturated fats. These are often found in the bodies of large animals and are usually not contributed to our dinner plates willingly. Virgin coconut oil does not inhibit the effects of the thyroid hormone, while many seed and grain oils have been proven to do so. Because a faster metabolism burns more weight off your body, a stronger thyroid function along with some physical exercise will help you lose excess body fat, or avoid you're putting it on in the first place.

In high technology era a Philippines research study shows that the coconut oil can delay as well as reduce HIV (human immunodeficiency virus) which spreads AIDS.

The breakthrough may come as a light at the end of the long dark tunnel in the worldwide fight against AIDS. The study, carried out by the government's San Lazaro Hospital and pharmaceutical giant United Laboratories since 1989, discovered that coconut chemical lauric acid inhibits delays and reduces the spread of HIV virus. Lauric acid is the basis of monolaurin and sodium lauryl sulfate which were found as the active chemicals promising in controlling HIV.

On July 19, 1995, Dr. Mary Enig, noted biochemist and nutritionist, was quoted in an article published in The HINDU, India's National Newspaper as stating that virgin coconut oil is converted by the body into "Monolaurin" a fatty acid with anti-viral properties that might be useful in the treatment of AIDS. The staff reporter for The HINDU wrote about Enig's presentation at a press conference in Kochi and reported on Dr. Enig's observation the Monolaurin helped in inactivating other viruses such as measles, herpes, vesicular stomatitis and Cytomegalovirus (CMV) and that research undertaken so far on virgin coconut oil also indicated that it offered a certain measure of protection against cancer-inducing substances. All the analysis of virgin coconut oil show that virgin coconut oil have big potential to develop and can generate the economy especially to add commercial value of coconut product.

### **1.3 OBJECTIVES**

The aim of this study/research is to produce virgin coconut oil. Hence, the objectives of this research are:

- The study of production virgin coconut oil via centrifuge and oven methods.
- The study of mechanism of demulsification.

### **1.4 SCOPE OF STUDY**

- Characterization (properties) of virgin coconut oil in term of physical and chemical properties.
- To study the effect of the temperature on virgin coconut oil production by heat the sample (*VCO*) below 60°C by using Oven)
- The range of rotation/speed is 6000, 8000, 10000 and 12000 rpm by using high speed centrifuge separator-Sorvall.

## **1.5 Significant of study**

Virgin coconut oil has many potential benefits that are yet to be discovered. By doing this research, it is hoped that virgin coconut oil would bring more and more values to the coconut trees. Thus, more land will be opened for the plantation of coconut trees. The country's economy will benefit from this as coconut sugar can be exported to other countries as demands increase. The people, as well, will have more job opportunities in the field.