PRODUCTION, UTILIZATION AND MARKETING OF VIRGIN COCONUT OIL

By Divina D. Bawalan

1.0 Introduction

Coconut oil is one of the most well-known and utilized products derived from the mature coconut meat or kernel. It is generally obtained by drying the coconut meat using different methods and then extracting the oil from granulated dried kernel through the use of high pressure mechanical press or a combination of high pressure mechanical press and solvent extraction.

Coconut oil in its purest form is water-white in color, with distinct coconut flavor and aroma and with free fatty acid content ranging from 0.05 - 0.08% (as oleic) without undergoing the chemical refining process. However, this type of oil is not readily available in the commercial market. The common color of coconut oil is yellow. This is because the current oil milling process being used in all coconut producing countries is based on copra as raw material input and not fresh coconuts. Copra drying and storage studies conducted under the RP-UK Aflatoxin Reduction in Copra Project revealed that the color of coconut oil (Figure 1) is determined by the manner in which copra is dried and by the action of microorganism and fungus during deterioration of copra. Likewise, the said studies revealed the following salient information:

- a. Sundried copra if processed under good weather conditions with sunny clear skies, high midday temperature and relatively low humidity produces water-white oil. However, sundried copra under Philippine weather condition for example, generally produces pink or red orange colored oil.
- b. The color deepens depending on the degree of deterioration of the copra before milling.
- c. Kukum (indirect type dryer) or hot-air dried copra produces water-white oil if drying is done to the right moisture content level and oil is extracted immediately after drying. However, kukum dried copra when stored with high moisture content (greater than 9%) produces yellow colored oil. The yellow color becomes darker as the degree of copra deterioration increases.
- d. Tapahan (smoke) dried copra produces yellow colored oil. The greater the degree of deterioration of copra before milling, the darker the yellow color becomes.

The color of the oil remains stable and does not change after extraction. However, the free fatty acid content (FFA) increases if the oil has high moisture content after extraction.

The proliferation of natural, herbal and beauty care products and specialty soap manufacturers and the growing prominence of aromatherapy and massage oils in the Philippines in recent years started to create a demand for chemically free, high quality white coconut oil. Both producers and users of this type

Figure 1: Different Colors of Coconut Oil
of coconut oil termed it “virgin coconut oil” although the industry has not yet set-up any quality standard on the said product. Making a parallel definition as that of “virgin olive oil”, virgin coconut oil may mean the naturally processed product from fresh coconut meat or its derivative (coconut milk and fresh residue) which has not undergone any further processing such as refining. It is water white in color with free fatty acid content below 1% (as oleic) and peroxide value of 10 meq iodine/kg of oil.

2.0 Production Process

2.1 Process Description

Virgin coconut oil (Figure 2) can be produced either from the processing of fresh coconut meat, coconut milk or coconut milk residue. This is categorized as shown below.

2.1.1 Desiccated Coconut (DCN) Route - involves undergoing all processes necessary for the production of desiccated coconut (de-shelling, paring, washing, grinding, blanching and drying) except sulfite treatment and then extracting the oil using a screw type press to produce virgin coconut oil and food grade full protein, medium, fat coconut flakes. The flakes can be further grinded to produce coconut flour. Disecated coconut products which did not pass the quality standards for color and microbial content can be processed to produce aflatoxin free coconut flakes for animal feeds.

2.1.2 Grated Coconut Route (Fresh-Dry Process) - involves splitting the nut, grating, blanching and drying the coconut meat and then extracting the oil using a screw type press to produce virgin coconut oil and food grade full protein, medium fat coconut flakes. The flakes can be further grinded to produce coconut flour. It should be noted that this is similar to the DCN Route except that this requires fewer process step and equipment.

2.1.3 Low Pressure Oil Extraction or Intermediate Moisture Content Method involves splitting the nut, grating the meat to fine particles, manually squeezing the milk either manually or by mechanical means, with or without addition of water and allowing the milk to ferment for 36 – 48 hours. Then the skim milk at the bottom is discarded, the oil that separated out is filtered and the cream which still contains part of the oil is gradually heated to further recover some oil. This process can be done under a home scale operation or can be partly mechanized under a small – medium scale plant operation.

2.1.4 Traditional Wet Process - involves splitting the nut, grating the meat to fine particles, manually squeezing the milk with addition of water and gradually heating the milk until all the water has been evaporated to produce the virgin coconut oil and proteinaceous residue or “latik”. One variation of the traditional wet process is allowing the milk to stand for 6 – 12 hours, then removing the skim milk that settles at the bottom and gradually heating the resulting cream to recover the oil.

2.1.5 Fermentation Process - involves splitting the nut, grating the meat to fine particles, squeezing the milk either manually or by mechanical means, with or without addition of water and allowing the milk to ferment for 36 – 48 hours. Then the skim milk at the bottom is discarded, the oil that separated out is filtered and the cream which still contains part of the oil is gradually heated to further recover some oil. This process can be done under a home scale operation or can be partly mechanized under a small – medium scale plant operation.

2.1.6 Bawalan - Masa Process - the production process was developed by the author together with her colleague, Dina B. Masa using the coconut milk residue from a
coconut milk manufacturing plant as starting material. It involves blanching the residue, drying at a specific moisture content level and subsequently defatting the residue under controlled conditions using a specially designed equipment to produce virgin coconut oil and low fat, high fiber coconut flakes. The flakes can be further grinded to produce coconut flour.

3.0 Characteristics and Uses

As a product that has been in the commercial market for several decades now, the use of copra derived and processed coconut oil for edible and non-edible applications are already well-established and too well-known that it is no longer necessary to list them in detail here. However, it is worthwhile to mention that in food preparations and in diet, coconut oil performs the following functions:

- Serves as an important source of energy in the diet
- Supplies specific nutritional requirements
- Provides lubricating action in dressings or leavening effect in baked items
- Functions as efficient heat transfer agents in frying
- Acts as carrier and protective agent for fat soluble vitamins
- Contributes to palatability and enhances the flavor of food.
- Excellent carrier for many types of active vitamins

Virgin coconut oil can also be utilized in all applications where crude, cochin and RBD oil are normally used and would be a much better alternative if it

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<th>Type of Process</th>
<th>Quality of Oil and Recovery</th>
<th>Advantages and Limitations</th>
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<tr>
<td>1. Desiccated Coconut Route</td>
<td>FFA - 0.05 - 0.08 %, M.C. - 0.07 - 0.1 %, Color - water white, Oil recovery - 560 kgs per ton (1000 kgs) of desiccated coconut</td>
<td>Produces full protein, medium fat coconut flour as a by-product, Long shelf-life of oil - 1 yr and above, About 90 % of available oil in the fresh meat is recovered, Uses mechanical type of equipment to produce the oil, High investment cost, medium scale plant operation</td>
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<tr>
<td>2. Grated Coconut Route</td>
<td>FFA - 0.05 - 0.08 %, M.C. - 0.07 - 0.1 %, Color - water white, Oil recovery - 300 kgs per ton of fresh grated meat</td>
<td>Produces full protein, medium fat coconut flour as a by-product, Long shelf-life of oil - 1 yr and above, About 88 % of available oil in the fresh meat is recovered, Uses mechanical type of equipment to produce the oil, Can be done under small scale plant operation</td>
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<td>3. Low Pressure Method</td>
<td>FFA - 0.2 %, Moisture - 0.17 % and above, Color - water white, Oil recovery - 25 kgs per 100 kgs of grated coconut meat</td>
<td>Uses manually operated equipment to produce the oil, 66 - 70 % of available oil in the fresh meat is recovered, Produces a semi-dry coconut residue that has to be further dried or processed to have market value, Shelf - life of oil is very short if not immediately dried after extraction</td>
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<td>4. Traditional Process</td>
<td>FFA - 0.06 - 0.2, Moisture - 0.07 - 0.14, Color - water white to yellow depending on the heating process, Oil recovery - 19 kgs per 100 kgs of grated coconut meat</td>
<td>Very low investment cost, Can be produced on a home scale operation using ordinary kitchen utensils, About 52 % of available oil in the fresh meat is recovered, Produces a wet coconut residue that has to be further dried or processed to have market value, Produces a by-product (proteinaceous residue) which does not have commercial value at present, Oil gets rancid after 5 days if oil is not properly heated to dryness</td>
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<td>5. Fermentation Process</td>
<td>FFA - 0.28 - 0.33 %, M.C. - 0.15 - 0.17 %, Color - water white, Oil recovery - 26 kgs per 100 kgs of grated meat</td>
<td>Can be produced on a home scale operation using ordinary kitchen utensils or on small-medium scale operation using semi-mechanized equipment, Roughly 66 % of available oil in the fresh meat is recovered, Disposal of fermented skim milk could be a big problem if done on medium scale plant operation</td>
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<td>6. Bawalan-Masa Process</td>
<td>FFA - 0.05-0.08 %, Moisture - 0.07 - 0.12 %, Color - water white, Oil recovery - 170 kgs per ton (1000 kgs) of wet residue</td>
<td>Further recovery of high value oil from residue makes coconut milk processing more profitable, Long shelf-life of oil - 1 yr and above, Produces low fat high fiber coconut flour as a by-product, Requires mechanical type of equipment to produce the oil, Production process has to be attached or integrated to an existing coconut milk processing plant</td>
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can be made available in large volumes at affordable price. For instance, in the manufacture of oleochemicals earmarked for cosmetic applications, the use of virgin coconut oil instead of copra derived oil will enhance the quality of the final product because of its hypoallergenic properties.

The most significant physical property of coconut oil, unlike most fats is that it does not exhibit gradual softening with increasing temperature but passes rather abruptly from a brittle solid to liquid within a narrow range. In this respect, it resembles cocoa butter. Coconut oil is liquid at temperature of 27 °C or higher and is solid at 22 °C or lower. This low melting point behavior is due to its low average molecular weight. Under this condition, coconut oil has the consistency of butter in temperate countries.

The presence of a high percentage of lauric fatty acid (45 - 53% depending on the coconut variety) and the other medium chain fatty acids, capric (7%), caprylic (8%) and caproic (0.5%) makes it distinct and unique. It is this property that distinguishes coconut oil from other vegetable oils in the world market.

One of the emerging application of virgin coconut oil that will give it a premier position among vegetable oils being traded in the world market is its medical use and functional benefit to human health. Dr. Mary Enig, a noted nutritional biochemist reported that coconut oil has a unique antimicrobial, immune-modulating, antitoxic and metabolic-enhancing properties when consumed that need to be further explored for the health benefit of the consumer and the market benefit of the producer. She added that the antimicrobial properties include antiviral, antibacterial and antifungal protozoal effects which are mainly due to the medium chain fatty acids and their derivatives formed in the gastrointestinal tract with lauric acid and its derivative monolaurin (monoglyceride of lauric acid) as the most important and effective. The said finding about the efficacy of monolaurin as an antibiotic and anti-viral agent was corroborated by the study done by Prof. John J. Kabara, Professor Emeritus, Department of Chemistry and Pharmacology, Michigan State University, USA and his colleagues. He noted that when coconut oil is consumed, the body makes the disease fighting monolaurin. It was also mentioned that the medium-chain fats in coconut oil are similar to fats in mother’s milk and have similar nutriceutical effects. In the Philippine front, Dr. Conrado Dayrit of United Laboratorics reported the use of monolaurin at different dosages on the first clinical trial involving 15 HIV-infected patients reporting regularly at San Lazaro Hospital. Viral, CD4 and CD8 counts, complete blood counts, blood lipids and tests for liver and kidney functions were taken at the beginning of the study and after 3 and 6 months of treatment. Results revealed marked improvement on most of the patients except for one who died 2 weeks after the study. The results confirmed the anecdotal reports that coconut oil does have an anti-viral effect and can beneficially reduce the viral load of patients afflicted with AIDS.

At present, the use of virgin coconut oil in the Philippines is focused on the preparation of aromatherapy and massage oils and in the manufacture of herbal and beauty care products.

4.0 Market Potential and Prices of Virgin Coconut Oil

The publication and subsequent distribution in the United States, United Kingdom and Australia of the book entitled “The Healing Miracles of Coconut Oil” by Dr. Bruce Fife, a nutritionist and naturopathic physician including the presentation in international fora of various researches and clinical studies done by Prof. Kabara, Dr. Enig, Dr. Dayrit and others and the information presented in selected websites have all contributed in creating awareness on the health benefits of coconut oil to the human body. This increased awareness is now being translated into a growing niche market for virgin coconut oil/coconut butter as a functional food, as a
preventive measure and cure for common illnesses and infectious diseases and as an agent for maintaining a healthy and beautiful skin and hair. There are now a growing number of people in the United States who actually take a daily dosage of 3 tablespoonfuls of virgin coconut oil and using the solidified product as substitute for butter in sandwich fillings and other food preparations. This developing market is manifested by the increasing volume of virgin coconut oil exports of a company in the Philippines. In addition, the internet abounds with a growing number of companies advertising and selling virgin coconut oil or its variations (e.g. coconut butter/cream, scented coconut oil for massage etc.).

On the other hand, prices of virgin coconut oil sold in the internet varies from US $ 10.00 per 500 ml bottle. US $ 18.95 per 454 g, US $ 17.00 per 360 g to US $ 50 per gallon depending on the supplier. The cost decreases as the volume or packaging size increases.

5.0 CONCLUSION

Based on the foregoing information, it is quite clear that the future of producing and trading virgin coconut oil appears to be good. It is in the benefit of the coconut industry to promote the production, utilization and marketing of virgin coconut oil and gradually wean from the traditional process of oil extraction based on copra. In this way, the quality and value of the product is upgraded. Likewise, inasmuch as virgin coconut oil cannot be produced in large scale plants and is best produced on a village scale of operation to maintain the quality, it creates a situation where coconut farmers can directly participate and get a bigger share of the profit of the industry instead of being a mere producer of copra. What is needed is the institutionalization of a system where an aggregator will collect the product from small producers and do the marketing as what is being done now by the company in the Philippines which is exporting virgin coconut oil.

The author is a Senior Science Research Specialist, Product Development Department, Philippine Coconut Authority who has done several pilot production trials to produce virgin coconut oil using different processes. She and a colleague has a Philippine patent pending for the technology on the production of low fat high fiber coconut flour and white oil from coconut milk residue.