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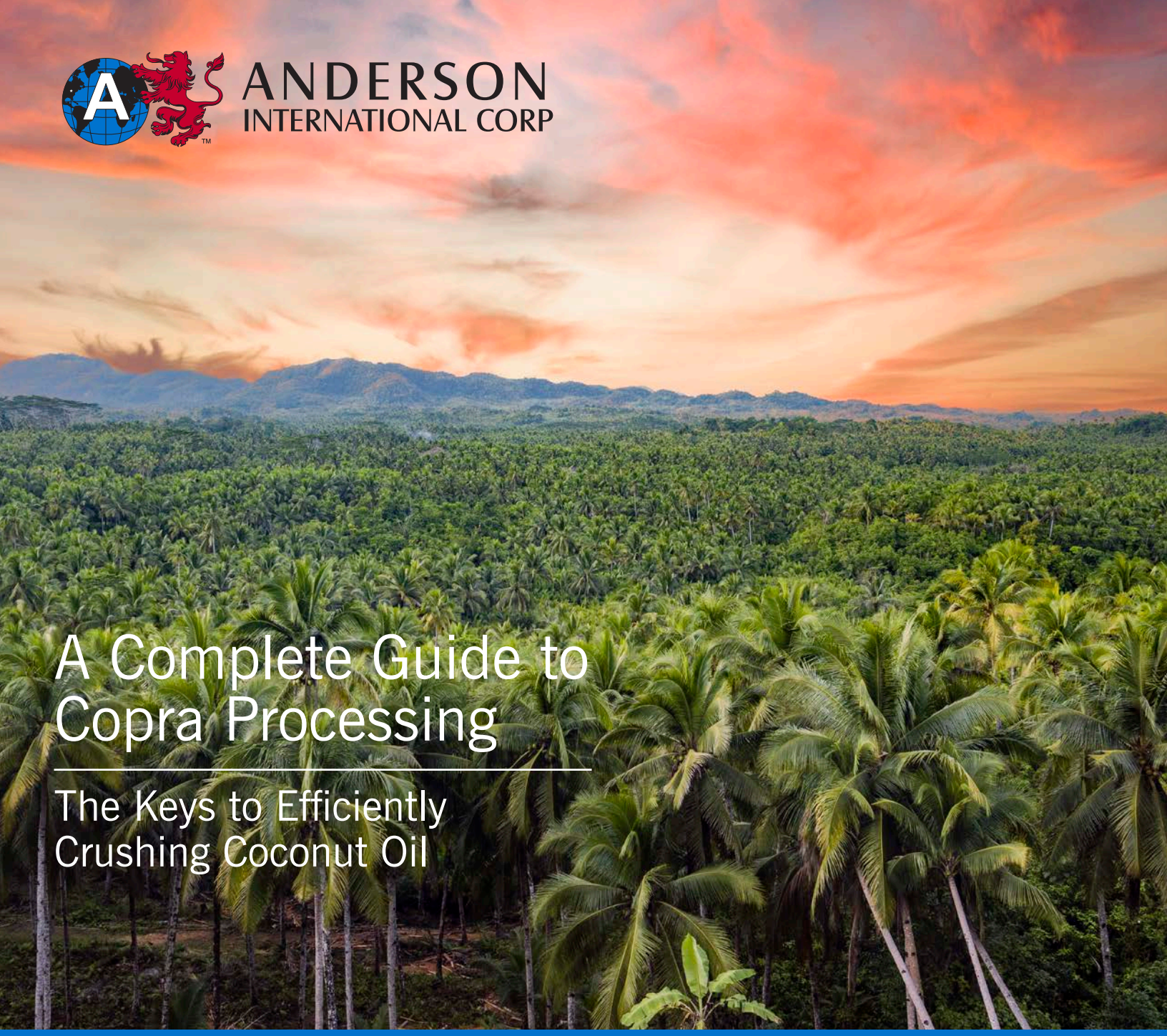

A Complete Guide to Copra Processing

The Keys to Efficiently Crushing Coconut Oil

An iconic symbol of the tropics, the coconut is commonly called the “Tree of Life” because every part of the plant serves a purpose. Coconuts provide food, fuel, fiber, water, utensils, and more, finding various uses around the world.

The most valuable byproduct of this versatile fruit is coconut oil, which is pressed from the dried meat or kernel of the coconut, known as copra. This edible oil is widely used as an ingredient in cooking, cosmetics, and industrial applications. Touted for its potential health benefits, unique fatty acid profile, and distinctive flavor and aroma, coconut oil has generated steady demand over centuries.

As research uncovers more benefits and potential uses for this versatile oilseed, the market for coconut products continues to grow. In this guide to copra oilseed processing, we’ll examine the history of coconut production, various copra processing methods, and diverse product applications as we explore the global growth potential of this multifunctional fruit from the “Tree of Life.”

Copra Market History

The oldest reference to the resourceful seed now known as coconut dates to the 5th century when an Egyptian traveler wrote about the “Indian nut” he encountered on his trip. Later, in the 9th century, an Arab merchant described the use of coconut coir fiber in China. The name “coconut” didn’t come along until the 1700s.

Coconuts were first cultivated in southern India and on the Pacific islands of Southeast Asia — including the Philippines, Malaysia, and Indonesia. Merchants introduced coconuts throughout Africa, Central and South America, and Mexico. By the 19th century, coconut had become a valuable trading commodity throughout the South Seas.

Global production of coconut oil now tops 3.5 million metric tons (MT). The Philippines leads production with nearly 1.7 million MT, followed by Indonesia with just over 1 million MT, and India with less than 500,000 MT. Other leading producers include Vietnam, Papua New Guinea, Sri Lanka, and Thailand.

Today, coconuts are grown as far north as Hawaii and as far south as Madagascar. Roughly 60% of coconut oil produced globally is exported to Europe and North America, the oil’s largest importers. The top consumers of coconut oil are the United States, Indonesia, and India, which comprise more than one-third of global consumption.

The worldwide market for coconut oil is expected to grow to $4.9 billion by 2023, spurred by its array of applications across industries and cultures. Increasing demand for coconut products, inconsistent resources, and its labor-intensive production process have led to a rise in its cost. Coconut oil prices peaked at $2,230 per MT in March 2022, averaging around $1,800 per MT over the last year.

To keep up with growing demand, coconut oil producers must find more efficient ways to process high-quality byproducts from this multifunctional seed to serve a range of important uses.

Cultivating Coconut

Coconuts grow on coconut palms (Cocos nucifera) in tropical regions worldwide. Despite its name, the coconut is technically not a true nut, but a one-seeded fruit known as a drupe. Coconuts—like other drupes, such as olives and peaches—contain three layers:

- The outermost layer, or exocarp, is the smooth, green skin of the raw coconut.
- The next layer is a fibrous husk called the mesocarp, also known as coir.
- The endocarp is the hard, brown, woody shell surrounding the coconut meat or kernel. When you see coconuts in the grocery store, you're typically looking at the endocarp.

Inside these layers, the coconut seed comprises the fleshy white meat, or kernel, and the nutrient-rich water inside the hollow cavity. Although the husk and shell serve commercial purposes as fiber and charcoal, most coconut-derived products originate from these edible innards.

Each coconut has three pores, or eyes, on the end of the endocarp. In fact, the word "coconut" comes from the Spanish "coco," meaning skull or scary face, because of these eyes. About nine months after a coconut seed germinates, a shoot emerges from one of these pores as the new coconut tree begins to grow. However, they are not actual trees, botanically, since they don't have bark, branches, or secondary growth, and the trunk is technically just a stem. Coconut palms are woody perennial monocotyledons that produce a single embryonic leaf in each seed.

Tall varieties of coconut palms reach 8 to 30 meters, or nearly 100 feet tall. These palms take eight to 12 years to start bearing fruit. Then, they produce year-round. It takes almost a year for each coconut fruit to mature, with new bunches forming every month or so. A coconut palm lives for up to 100 years and can produce about 100 coconuts a year. On average, one hectare of coconut palms can yield between 10,000 and 14,000 nuts.

Mature coconuts drop to the ground where they are harvested. The fruit's age and ripeness can affect the oil's quality and yield—with immature coconuts having lower yields and producing inferior oil. Typically, processing one thousand mature coconuts yields up to 375 pounds of copra, from which about 18.5 gallons of coconut oil can be extracted.

Preparing Coconuts for Processing

Coconut farmers and plantation workers break down coconuts through a labor-intensive process. First, they remove the outer husk by hand, which can be used to make rope and other fibers. Then, they split open the shell of the coconut with a machete to drain out the liquid. Typically, coconut water is harvested from less mature coconuts that contain more liquid than mature coconuts, which are cultivated specifically for copra and oil production.

Fresh coconut kernels contain about 50% moisture, 34% oil, 7.3% carbohydrates, 3.5% protein, 3% fiber, and 2.2% ash by weight. These raw kernels may be processed into virgin coconut oil.

Alternatively, the coconut meat may be dried at the farm to separate the shell and obtain copra, which can then be processed to produce coconut oil. Farmers use various methods to dry this meat—either by exposing it to the sun for several days, smoking it over fires made of burning coconut husk or coir, or using a combination of sun-, smoke-, and kiln-drying.

Regardless of the method used, copra drying is not a consistent or controlled process. Sun-dried copra is generally of higher quality, as smoke can darken or burn the fleshy white coconut meat. After drying, copra contains between 60-70% oil and 5-10% moisture by weight—although moisture levels might be as high as 20%, depending on the drying process. These inconsistent moisture levels can cause challenges for processors downstream.

Copra, if not properly dried, can be susceptible to harmful molds like Aspergillus flavus. These molds can produce aflatoxins that can be highly toxic if ingested. Only mature nuts should be harvested and then protected from rain and moisture to minimize mold occurrence. Copra samples are typically tested for aflatoxin contamination prior to shipping from remote, tropical locations.

Processing Copra Oil

Unlike other oilseeds that arrive at the mill as small seeds, copra chunks require multiple grinding steps to reduce the size of the material for processing. These size reduction steps typically include:

- A hammer mill that grinds the copra chunks into half-inch (10-12 mm) pieces after one or two passes.
- A cracking mill or corrugated roller mill that breaks these pieces down to one-quarter to one-eighth of an inch (3-6 millimeters) in size.
- A flaking mill that squeezes these small pieces into flakes less than one millimeter thick.

Typically, processors feed flaked copra into stacked cooking and drying vessels to reduce the moisture levels to 3-4%. Then, cooked, dried copra flakes head into a continuous screw press expeller. Processors typically press this oil-rich material twice to release as much oil as possible.

The **Anderson Super Duo™ Series Expeller®** is ideal for processing copra oil, since its unique dual-press design crushes the material twice in a single pass for more efficient pressing. There are currently more than 700 of these machines at processing facilities throughout the Philippines and Indonesia, which produce the bulk of the world's coconut oil.

The expeller press uses mechanical force to squeeze oil from the copra, leaving a cake of copra meal that contains about 5-7% residual oil. The crude oil is further filtered and refined, as we'll explain in depth below, while the solid meal is used as livestock feed.

Copra Extrusion

While most coconut oil mills rely on the traditional double-press method of mechanical extraction, increasing market demands force processors to explore more efficient, streamlined solutions. This has pushed some processors to install high-shear dry extrusion systems to reduce the overall number of steps (and the amount of equipment and energy required) throughout the process.

An extrusion system like the **Anderson Dox™ Extruder** uses mechanical energy to efficiently cook, dry, and shear the raw copra material. The **multifunctional machine** can reduce the equipment footprint in a facility while lowering energy costs, eliminating the need for multiple grinders and heating vessels to separately crack, flake, cook, and dry the material. Whereas traditional pressing requires that copra be dried to 3-5%, the extruder can process copra at 6-8% moisture.

Like an expeller, a rotating screw conveys copra through the extruder. The mechanical force creates a high-pressure, high-shear environment that breaks down the copra, releasing the oil inside. Meanwhile, the high pressure and temperature destroy harmful substances and flash-dry excess moisture without degrading the quality of the coconut kernel.

The extruded copra may then be fed into an expeller for improved oil recovery. When a high-shear extruder like the Dox is installed upstream, the Anderson Expeller can reduce oil residuals to less than 6% in most materials, doubling the press's capacity and extending the life of the press.

Containing up to 70% oil by weight, coconuts have the highest oil content of any oilseed. This concentration can clog and flood processing equipment designed for lower oil content seeds like soybeans unless machines are modified to handle the extra oil flow. The Dox Extruder is currently the only extruder on the market with an optional drainage cage to drain this excess oil, allowing oil-rich copra to be pressed more efficiently and with less mess.

Coconut Oil Applications

Virgin coconut oil (VCO) is processed directly from raw coconut meat or milk without chemical processing. In contrast, crude copra oil or coconut oil (CNO) undergoes additional refining to remove impurities and contaminants before it hits the market. Although both types are considered pure coconut oil, these refining steps differentiate CNO and its unique composition.

Traditionally, crude oil is treated with a small dilution of phosphoric or citric acid to remove phospholipids in a process known as de-gumming. Then, the oil is bleached with activated charcoal or clay to clarify the color. Finally, the oil is de-acidified through filters and steam-deodorized in a vacuum. The last stage of refining removes coconut's desirable odor and nutrients, leaving little to no distinctive coconut taste and smell. Some manufacturers add these components back into the final product.

Copra oil contains one of the highest proportions of saturated fat to unsaturated fat compared to other plant-based oils. Its composition gives coconut oil a longer shelf life than vegetable oils high in unsaturated fats, like **sunflower** and **soybean**. Such oils are more prone to oxidization and rancidity. However, coconut's low melting point of 19-22 degrees Celsius (66 to 72 degrees Fahrenheit) means it solidifies at room temperature, which can complicate storage and transportation compared to other liquified oils.

Specifically, the fatty acids in coconut oil include:

- Lauric acid (48%)
- Myristic acid (16%)
- Palmitic acid (9.5%)
- Capric acid (8%)
- Caprylic acid (7%)
- Oleic acid (6.5)

These fatty acids serve important roles in many different applications, as we'll explore below.

Edible Fat

Because it is easily digested, has a desirable flavor profile, and is resistant to rancidity, coconut oil is an ideal ingredient in the food industry. It is commonly used in baking and cooking to replace butter or margarine and to produce baked goods, non-dairy creamers, and snack foods.

Coconut oil is often considered one of the healthiest fats due to its unique fatty acid composition. Most of the major fatty acids in coconut oil are medium-chain triglycerides (MCTs), which are digested, absorbed, and metabolized more rapidly than any other fats. Many people tout coconut oil as a weight loss aid for this reason, and some trials suggest that it can reduce body fat. However, saturated fats like coconut oil should be consumed in moderation.

Coconut provides a significant amount of manganese, a mineral that helps maintain healthy brain, immune, and nervous system functions. Some studies show that coconut fat can normalize body lipids and alleviate inflammation. Certain chemicals found in the oil, particularly ketones, have been associated with reducing the symptoms of Alzheimer's disease by providing energy sources for damaged brain cells.

Regarding heart health, some research suggests that coconut oil can increase HDL (good) cholesterol, making coconut oil an essential part of a heart-healthy diet. However, coconut oil consumption can also increase LDL (harmful) cholesterol levels, which could increase the risk of coronary heart disease. Despite the rising popularity of coconut oil's purported health benefits, additional research is required to understand its effect on cardiovascular disease risk.

Beauty and Cosmetic Products

Due to its moisturizing qualities and pleasant aroma, coconut oil is frequently incorporated into cosmetic products for healthy hair, skin, nails, and teeth. Applied as a topical, coconut oil can moisturize dry skin and enhance skin barrier function to prevent excessive water loss.

Similarly, coconut oil can protect against hair damage by nourishing and strengthening strands to prevent breakage, leaving hair smooth and shiny. People also use coconut oil as a mouthwash in a process called oil pulling, which benefits oral hygiene by reducing harmful bacteria in the mouth.

Soapmaking

Lauric acid, which comprises about half the fatty acids in coconut oil, is used to produce specialty soaps and surfactants. Lauric soaps retain more water than soaps made from other oils, making them more soluble and more conducive to quick lathering. For the same reason, coconut oil is widely used for other industrial purposes, including detergents, surfactants, paints, and varnishes.

Pharmaceutical and Nutritional Products

The body converts lauric acid into the monoglyceride monolaurin, which exhibits antiviral, antibacterial, and antiprotozoal qualities. Some reports suggest that monolaurin can destroy lipid-coated viruses like HIV, herpes, influenza, and bacteria like Listeria. Babies synthesize monolaurin from the lauric acid of breastmilk, so coconut oil is often recommended as an ingredient in infant formulas, where it promotes the absorption of fat and calcium during development.

Copra Meal

After oil extraction, the remaining meal contains residual oil, significant quantities of protein (between 18 to 25%), and even higher quantities of dietary fiber. Humans cannot consume this fiber concentration in large amounts, but it is a source of high-quality protein for ruminants since it doesn't break down in the rumen.

Copra meal is commonly used as fodder for cattle, horses, sheep, and deer. As a primary product in horse feed, copra meal can improve the texture of equine skin and hair, promoting a healthy coat. The high fat content of copra meal also helps fatten livestock, increasing the growth rate of pigs and poultry.

The Future of Coconut

Copra plays a significant role worldwide as an essential commodity serving many applications. As a highly coveted edible fat and a desirable component of pharmaceutical, nutritional, cosmetic, and industrial formulations, coconut oil provides benefits across industries.

As the global demand for healthy, versatile oil continues to grow, copra is positioned for steady demand as new research uncovers more information about its benefits. To tap into this tropical crop's potential, processors must continue to innovate their approach to making copra crushing more efficient and economical.

With decades of experience processing this unique oilseed around the world, Anderson International can help optimize your copra oil plant for maximum success. **Contact Anderson's extraction experts to learn more about processing quality coconut oil for any application.**

Fun Coconut Facts:

- The famed mutiny on the Royal Navy vessel, HMS Bounty, was supposedly triggered by Captain Bligh's harsh punishments for theft of coconuts from the ship's store.
- When intravenous (IV) solution was in short supply during World War II and the Vietnam War, doctors substituted coconut water instead.

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