

Making Calamansi Powder at Home

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Calamansi

Calamansi (*Citrus microcarpa*), known as calamandin and kalamansi, is a unique citrus plant on Guam and the Pacific islands. Calamansi is a natural hybrid of mandarin and oval kumquat (*Citrus reticulata* × *Citrus japonica*). The fruit has a sweet mandarin-like aroma, a taste of lime, and a hint of acidic astringency. The juice is tart with a pH, titratable acidity, and sugar content at 2.5, 5.6-5.0% (citric acid), and 7.1-8.5%, respectively.

The calamansi tree produces year-round fruit; the harvest peak season is from March to July on Guam. Many residents have calamansi trees in their backyards and use calamansi as an ingredient for seasoning or preparing various foods. For example, people use calamansi to prepare lemonade, tea, cocktails, marmalade, jams, sauces, noodles, and various dishes. Calamansi is also used to prepare Chamorro traditional food “kelaguen” and marinate chicken and ribs before grilling.



Figure 1. Calamansi fruit.

Health Benefits of the Citrus

Citrus fruits are rich source of vitamins, minerals, polyphenolic compounds, and dietary fibers providing health benefits. Citrus juice and peels contain unique citrus

flavonoids, a group of polyphenolic compounds, including flavanones, flavones, flavonols, and anthocyanins. Citrus flavonoids possess properties of antioxidant, anticancer, anti-inflammatory, antimicrobial, and cardiovascular protection activity. A subgroup of citrus flavonoids called polymethoxylated flavonoids (PMFs), which have four or more methoxy groups on their basic molecular skeleton, exhibit high bioactivities of these properties at low concentrations. Citrus peels contain a higher amount of PMFs, such as nobiletin, tangeretin, and sinisetin, than the juice does.

Citrus peels have been used as functional ingredients to improve food quality and safety. For example, citrus peel extracts are used in meatball and fish product to prevent lipid oxidation. Citrus peels are mixed with soybean during fermentation of soy sauce to increase polyphenolic compounds for health benefits.

Although citrus peels possess higher amounts of phenolic acids, flavonoids, dietary fibers, minerals, and vitamins than the juice does, people usually only consume the juice and discard the peels and seeds. Calamansi is currently underutilized. However, processing calamansi peel powder used as a functional food ingredient may add value to calamansi and benefit agriculture production.

Food Dehydration

Dehydration is a process of using heat to remove most of the water present in food. The shelf-life of dried foods extends greatly by inhibiting the microbial growth and enzymatic reactions in products. The process of dehydration generally involves three steps: (1) food absorbs the heat from the surrounding drying hot-air; (2) the water on the food surface absorbs the heat and evaporates; and (3) the drying air removes the water vapor from the food surface. Normally, drying food requires a temperature at 140 °F, an air relative humidity below 60%, and a sufficient air velocity to remove the water’s vapor.

Using a food dehydrator is an efficient way to dry food at home because the dehydrator equips electric elements for heating and circulating air through a fan and vents. A thermostat enclosed in a dehydrator can control the dehydration temperature from 29 °C to 71 °C (85 °F to 160 °F). A dehydrator often has four to ten open trays for foods to be dried.



Figure 2. The horizontal and vertical air-flow dehydrator.

There are two types of dehydrators. The horizontal air-flow dehydrator has a heating element and fan located on the unit's side; all trays receive equal and heating penetration. The vertical air-flow dehydrator has a heating element and fan located at the base; foods on the bottom trays receive more heat than those on the top trays; and the vertical air-flow can mix flavors of various foods on different trays. Both horizontal and vertical air-flow dehydrator can be used to dry calamansi fruit.

Using oven is another option to dry foods at home. Since the oven has no built-in fan for air movement, the drying process is relatively slow, inefficient, and consuming more power than a food dehydrator. When drying foods with an oven, set the temperature at 60 °C (140 °F) and leave the oven door open 2-6 inches. To improve the air circulation, using a fan outside the oven door is recommended.

Processing calamansi powder

Figure 3 shows the flow chart of processing calamansi powder, and the following describes the procedures to make the powder.

Receiving

To make high quality calamansi powder, select mature, ripe fruit with orange peel color. should be obtained. The fully ripened fruit provides good citrus flavor and correct acidity, whereas unripe green fruit produces a bitter taste.

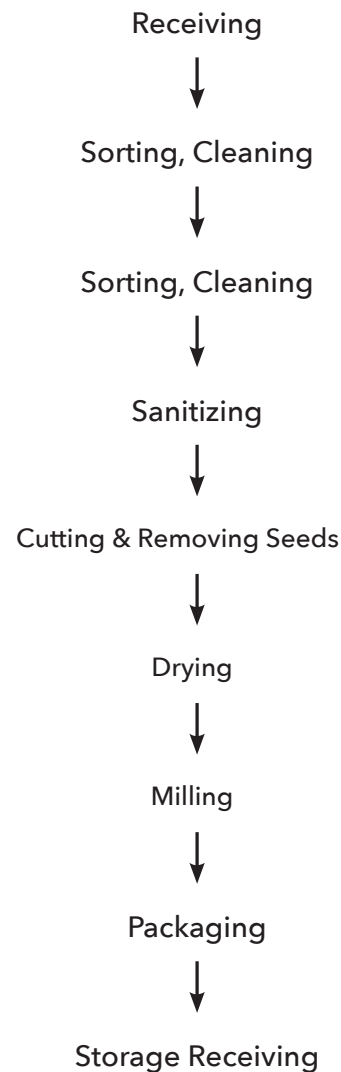


Figure 3. Flow chart of making calamansi powder.

Sorting and cleaning

Calamansi fruit may contain dirt, back dots, and defects on the peel. Sort and discard any fruit with decay, bruises, mold, or defects that affect food quality and safety. Clean and wash calamansi fruit under cold tap water thoroughly; scrub peel to remove all debris, dirt, and/or back dots on the calamansi peel.

Sanitizing

Fruit surfaces may contain foodborne pathogens. Sanitizing the fruit can reduce the number of pathogens on the fruit. To sanitize the fruit, prepare a sanitizing solution of 200 ppm chlorine by adding 2 tsp of bleach in one gallon of water. Then, soak the fruit in the sanitizing solution for 3 minutes, and air dry the fruit.

Cutting and removing seeds

It is not efficient to remove moisture if drying the whole calamansi fruit. Cutting the fruit in half in the middle can reduce the dehydration time. The calamansi seeds contain bitter compounds and negatively affect the sensory quality of the product. Remove seeds from the halved fruit with a small knife or a similar tool before drying.



Figure 4. Dry calamansi fruit using horizontal air-flow dehydrator

Drying

A food dehydrator is ideal for drying the calamansi fruit. Place the halved calamansi in a single layer on the trays of the dehydrator. Set the temperature at 60°C (140°F) and dry the fruit for at least 18 hours until no moist areas in the center. The dried pieces of calamansi appear shrunken, but the color will remain. The dried calamansi will produce a “snap” sound when broken. Cool the dried calamansi for 30-60 minutes.



Figure 5. Calamansi fruit before, during, and after dehydration using vertical air-flow dehydrator.

Milling

Before milling, inspect the dried pieces of calamansi. If there are any seeds, remove them. Grind (or mill) dried pieces of calamansi into powder using a grinder (or a miller). The calamansi powder should appear uniform in

color after grinding. If needed, add ingredients such as sugars, sweeteners, or anti-caking agents during grinding.



Figure 6. The ground calamansi powder.

Packaging

Package calamansi powder immediately after milling because the dried powder can easily absorb moisture from the surrounding air, especially in tropical climate. For packaging, always use food-grade materials or materials approved by the FDA. Glass canning jars, ceramic containers, plastic freezer containers, plastic freezer bags, and food-grade polyethylene bags are safe packaging materials. Clean and sanitize the containers before packaging. Seal the jars, containers, and bags tightly after packing to avoid moisture absorption and insect infestation.

Active packaging is a novel technology to control oxygen, moisture, and gas content in a package. Commercial oxygen scavengers, moisture absorbers, or odor and off-flavor absorber in sachets can be used in the package for dried food products. Commercial packing products are available on the market with guidance and directions for safe use at home. Follow all steps and processes outlined by the manufacturer of these products.

Storage

Dried calamansi powder should be stored in a dark, dry, and cool place. High temperature, sunlight, and moisture can degrade the quality of dried calamansi powder and negatively affect the texture, color, flavor, nutrients, and functional properties. Calamansi powder stored at 24 °C (74 °F) can last up to 3 months in shelf storage. For refrigerator storage at 4 °C (40 °F), calamansi powder can last up to 6 months.

Use of calamansi powder

Calamansi powder possesses a unique citrus flavor and citric acids. The powder can be used as a flavoring

or acidic ingredient to prepare a drink, tea, beverage, cocktail, and dishes and marinate meats and seafood. Calamansi powder can also be used to formulate dairy, pastry, bakery goods, and other food products. Due to high antioxidant capacity, calamansi powder can be added to meat and fish products to prevent lipid oxidation.

Table 1 provides a simple recipe to make a beverage using calamansi powder. First, in preparation, use a small amount of water to moisturize and dissolve calamansi powder, avoiding clumps. Second, fill the mixture in a pitcher and then add water and sugar and mix them well. The calamansi powder is easily dissolved in water. It is normal to see some undissolved peel particles at the bottom pitcher after preparing the drink. You could also pour the entire mixture through a fine-mesh strainer to remove the particles. Chill the drink in the refrigerator before consumption. You could just add one teaspoon of calamansi powder into commercial orange juice to obtain a juice with strong freshness and citrus flavor for other simple application.

Table 1. Recipe to prepare calamansi drink by calamansi powder.

Ingredient	Amount (gram or liter)	Amount (tbsp or cup)
Calamansi powder	30 g	3.6 tbsp
Sugar	50-100 g	4-8 tbsp
Water	1 liter	4.2 cups



Figure 7. Calamansi drink made of calamansi powder.

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Food Safety

To process calamansi powder, always practice good personal hygiene, wash hands with warm soapy water, clean and sanitize utensils and packaging materials, food contact surfaces, and avoid cross-contamination before, during, and after processing. During storage, if the calamansi powder has mold, undesirable color or flavor, or any signs of spoilage, please don't use and discard it immediately

For further information

Contact the University of Guam, Cooperative Extension and Outreach at 735-2080 for help or more information. Additional publications can be found on our website at: uog.edu/extension/publications.

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