



Quality control requirements of coconut based food products*

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To produce top-quality coconut-based food products, it is absolutely essential that quality standards be established and strictly adhered to by the industry and government agency concerned. These standards must constantly be observed not only in the process but also with regard to raw materials and ingredients, specifications and storage which can easily downgrade a product if neglected.



Introduction

Advances in food science and technology point towards the improvement of the existing processes for better product quality and process efficiency. They involve the thorough understanding of the fundamental behavior of foodstuffs and food processing systems, thermal and physical properties, heat and mass transfer, the behavior of microorganisms and deteriorative chemical reactions (Thorne, 1989). In addition, new knowledge and concerns have emerged regarding biotechnology and foods, food safety, environmental issues, packaging technologies, new processing technologies such as ohmic heating and super-critical fluid extraction, government regulations, globalization of foods, nutrition and others (Porter and Hotchkiss, 1995).

The recent globalization of food trade is a challenge to food scientists in establishing international food standards to promote and facilitate world trade. Many types of quality standards evolved to ensure food quality, including research, trade, and government standards (Porter and Hotchkiss, 1995). Research standards are the internal standards set up by a company to help ensure

the excellence of its product in a highly competitive market. Trade standards are generally set up by members of an industry on a voluntary basis to assure at least maximum acceptable quality and to prevent the lowering of standards of quality for the product of that industry. On the other hand, Government standards include among others the mandatory standards that protect health and prevent deception of the consumers.

Recent developments in the food industry directly affected manufactured food products derived from coconut. There should be slight alterations on the basic unit operations or selection and combination of unit operations, systematic quality control program that should begin with consumers specifications and market demand, and application of new concepts in product quality and safety such as Top Quality Management (TQM) and Hazard Analysis and Critical Control Points (HACCP).

Quality Assurance in Coconut Food Products Processing

In the manufacture of food products, the main concern is its acceptability to the consumers. Acceptability can be highly

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subjective but consumers generally choose food based on its quality which include taste, appearance and nutritive content. Quality is defined as the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (Sanchez, 1997). The quality of a product can be assured only if all planned and systematic actions necessary are met to provide adequate confidence that a product or service will satisfy the given requirement for quality. In order to achieve this, quality control techniques should be applied during raw material production, product manufacture, distribution, and marketing.

Raw Materials Specifications, Handling and Storage

Raw materials include any material/ingredient that is transformed by processing, packaging and/or storage into a food product. These raw materials directly influence the quality of the processed product hence quality specifications as well as strict sanitation practices are important considerations.

The quality of the coconut available for processing specific food product is influenced by the method of harvesting and the diversity of coconut varieties. Traditionally, coconut is harvested on a 45-day cycle mainly for the copra processing industry. Considering that within the bunch of nuts, maturity index differs, strict quality control at the processing plant must be done.

The quality control operations for coconut include maturity, weight,

size and freshness. Generally, coconut-based food products such as cream/milk, desiccated, and chips among others, requires 10-12 month old nuts where the color of the husk is partly green and partly brown, the fibrous inner portion of the husk is relatively dry and the color of the shell is dark brown. In practice, however, nuts are already dehusked when delivered to the processing plant so that acceptable quality control index applied during inspection is the presence of splashable water inside the nut when shaken and the absence of haustorium. The size should have a minimum diameter of 4 inches or approximately 900g/nut. This quality inspection must be done as soon as the nuts are harvested otherwise there will be misleading evaluation.

In coconut milk/cream products, when immature nuts are used it has low yield of milk and the emulsion is hard to destabilize while over mature nuts result in deterioration of coconut flavor. In addition, immature nut causes clogging of screw press thus delaying the extraction process. Meanwhile, the use of over mature nut in desiccated coconut manufacture results in early on-set of rancidity in the product due to the high oil content of the raw material.

In *nata de coco* production, 9-10 month old nuts are the most suited maturity due to the presence of optimum nutrients needed for the growth and multiplication of *Acetobacter xylinum*, the organism producing *nata*. Similarly, this stage of nut maturity contains lesser oil which is good for the organism. The

specification on the other ingredients include the use of refined sugar to prevent the introduction of harmful microorganisms and the production of brownish colored *nata* when lower grade sugar is employed, high quality glacial acetic acid (99.85 per cent), potable water and efficient strain of the *nata* organism.

Coconut products requiring younger (6-9 month old) nuts are dehydrated/dried *buko*, *buko* strips and rolls, canned *buko*, and beverage, among others. Previous studies have shown that the physical and chemical properties of the kernel and water in the nuts is affected by maturity. The increase in weight of the kernel appeared to be fairly linear up to 9 months and as the kernel weight increase there is a decline in the amount of water (Dolendo, 1967; Jayalekshmy, *et al.*, 1986). Reducing, non-reducing and total sugar content increased up to 8 months while pH and total titratable acidity in the water decreased with maturity.

Young tender coconut is one of the newest and popular commercial export product. The major suppliers of tender nuts are Malaysia and Sri Lanka while Philippines and Thailand has a small share in the export market (Punchihewa, 1994). Generally 7-8 months old nuts are required for best quality. At this stage there is maximum amount of water in the nut and abundant amount of sugars, minerals and other nutrients. Majority of the cultivars suitable for tender nut are the dwarf and aromatic type coconut. During harvesting, the right tender nut bunch must be carefully identified. Two methods are followed in the selection of the



right maturity for tender nut (Kamaruddin, 1997). First, a reference bunch is identified and immediately below from left to right of this bunch, tender nuts are harvested. The second method involves the identification of the bunch number by taking the bunch with a newly opened spathe as the first bunch and counting up to bunch no. 9 as the right bunch for tender nuts for Malaysian Red Dwarf and Malaysian Tall and bunch no. 10 for the MAWA variety.

The maturity index required for some coconut-based food products is shown in Table 1.

Table 1. Coconut-based food products and its coconut maturity requirement

MATURITY (month)	PRODUCT
6-7	<i>buko</i> roll, leather-type product, instant <i>buko</i> juice
7-9	Canned <i>buko</i> in syrup, fresh young tender nut, dried <i>buko</i> chips/crisps, pie filling, and other beverages.
9-10	Nata de coco production, sweetened meat bars (<i>bukayo</i>)
10-12	Desiccated coconut, creamed coconut, canned coconut milk, sweetened coconut milk (condensed, jam, honey, syrup, candy), unsweetened coconut milk (evaporated beverages), cheeses (white soft cheese, processed, cheddar, blue, etc.), coco yoghurt, coco skim milk (cultured beverages, powder, protein isolate, sweetened condensed, etc.) dehydrated edible coconut kernel, coco flour and others as ingredient for baked products.

Similarly, strict quality control must be done on the ingredients used in the manufacture of coconut food products. The ingredients must meet whatever performance and purity specifications required by the end-users. They should be reasonably free from harmful contaminants and should meet all the criteria for standards of identity and safety established by regulatory agencies of the government.

The common ingredients in processed coconut-based products are sugar and water. Sugar is known

to contain spore-forming microorganisms that may survive the processing methods employed. Sugar should therefore be of high purity and with low moisture content to prohibit the growth of microorganisms. On the other hand, water may contain pathogenic microorganisms such as *Salmonella*, *Shigella*, *Escherichia* and *Vibrio* species and harmful chemicals that can cause off-flavor, odor and off-color to products and cause food-borne illness to consumers. In as much as the industry utilize water for washing raw materials, product preparation and formulation, steam

and water sterilization of containers and equipment, product cooling and plant clean-up, proper water treatment facilities must be installed in the processing plant. This will ensure that potable water is available for plant operation. Formulation water being a constituent of the food and beverage must be of highest purity and potability and must be free of unwanted flavors and odors.

Coconuts are rarely used right away when they are received in the plant. Therefore, they must be stored in clean, dry, and well ventilated bins

with temperature as low as possible and relative humidity of approximately 50 per cent. Nuts must be stored for a maximum of 5 days to prevent the loss of meat quality and weight. Crack nuts that resulted from improper handling must be removed since this will serve as a medium for microbial growth and thus may contaminate the other nuts. Duration of storage must be monitored and controlled by observing the first in-first out rule.

Quality Control Requirements During Processing

The method of quality control procedures followed during processing of coconut-based food products depends on the type of product being manufactured. For instance, processing of coconut milk/cream and desiccated coconut involves pre-treatment procedures such as shelling, paring, removal of water inside the nut, washing, and trimming. Shelling operation is done manually or by mechanical sheller where in both cases breaking of some kernels cannot be avoided. Care must be observed to produce whole kernel with minimum bruises to facilitate fast and easy handling during paring and to prevent exposure of the meat to oxidation and microbial contamination. Paring or removal of the brown outer skin or testa of the coconut meat must be carefully done so that only 0.045 to 0.05 inch is removed to maximize the recovery of the white meat. Broken kernel must be pared first before the whole kernel to prevent over-oxidation. Similarly, all the testa must be removed to avoid gray discoloration and off-flavor to the processed product. Pared nuts



should not be allowed to be exposed to the air for more than 2 hours. They should be immediately washed, cut and further inspected for the presence of some discoloration, pieces of testa and small haustorium. Chlorinated water (50 ppm active chlorine) sprayed through the nozzles onto the meat is recommended for washing since application of hot water might result in the coagulation of the coconut proteins rendering it to adhere to the solid residue during the extraction process.

The pre-treated kernel should be processed within 4 hours so as to prevent the quality deterioration of the product. Proper monitoring during processing must be done so that the earlier batch of pre-treated kernels must be processed first.

Coconut water contains nutrients that favor the growth of microorganisms. Therefore, removal of water must be done properly by providing a system where water is continuously collected in a receptacle. Allowing the water to splash in the floor encourage unsanitary conditions in the plant. In case where the coconut water will be processed into other products, an aseptic collection system must be installed.

Dehydrated coconut meat products: The only dried coconut meat product that is traded commercially worldwide is the desiccated coconut. Other dried products that are found to be technologically feasible to produce but are mostly domestically marketed are the dried edible coconut kernel (whole or ball), chips, crisp, and flour.

Processing of desiccated coconut requires proper selection of coconut, strict hygienic practices and quality control during processing, packaging, and storage; packaging of uniform cuts of the different forms (threads, shreds, strips, chips, slices, fancy cuts, etc.), and maintenance of the required moisture content (2-3 per cent) in the packaged product for stability and retention of flavor and color. The specifications required by the international markets are satisfied by the desiccated coconut manufacturers in the Philippines hence it has dominated the world market. Other countries failed to observe proper sanitation and operational control during processing resulting to poor quality and unstable product. For instance, a recent study in India revealed that the desiccated coconut produced in that country contained high bacterial load consisting of *Salmonella*, *Escherichia coli*, *Staphylococcus* and other microorganisms (Sandhu, *et al*, 1991). An alarming result was the presence of *Staphylococcus aureus* on all the samples tested, an indication that this enterotoxin producing bacteria was a post-processing contaminant introduced through the food handlers.

In manufacturing desiccated coconut, the processing operations employed must guarantee that the product should have the desired flavor, color, texture and purity and that maximum quality control is maintained at every step. The desiccated coconut must be packed in a multi-wall kraft paper bag lined inside with polyethylene sheet and must be stored in well-ventilated warehouses. Before shipment, the microbial test must yield a zero

count for *Escherichia coli*, *Salmonella* and *Staphylococcus*. During shipment the container van must be thoroughly cleaned and sanitized and must be tested whether it is water proof before loading the desiccated coconut. Similarly, the container must not contain any other product especially those with smell because desiccated coconut easily absorbs any odor from the environment.

In processing of dehydrated edible coconut meat, the use of immature nuts must be avoided to prevent shriveling of the dried meat. Nuts must be shelled first before undergoing the pre-treatments to eliminate the source of infections from the husk and shell. Shelled halved nuts must be washed with water to remove the sugars coating the kernel and then should be immediately pasteurized at 82-90°C for 10 minutes in 2 per cent sodium metabisulfite solution. This pre-treatment sanitizes the kernel as well as inactivate the enzymes that cause browning and tissue degradation. Moisture content of the dried product must be maintained at 4-6 per cent, packed in polyethylene bags and stored in a clean and well-ventilated place.

Coconut flour is a product produced from mature nuts either by the dry or wet method. When coconut flour is manufactured by the dry process, care must be observed during the extraction of the oil from the dried kernel. The temperature and pressure applied must be regulated so as to avoid the denaturation of the coconut proteins and the depletion of other nutrients. Similarly, application of high



pressure generates more heat thus affecting the color of the coconut flour. In the wet process, the meal or residue obtained after the extraction of the milk from the comminuted kernel must be dried immediately to prevent microbial deterioration causing the discoloration and spoilage of the powdered product. It is best to manufacture coconut flour from 11-12 month old nuts to prevent the gummy texture of the product when younger nuts are used.

Coconut milk/cream products:

In the processing of coconut milk/cream products, quality control points include: (1) grinding of the meat to fineness followed by effective maceration or comminution. When this operations are not observed, there will be low milk yield and will also enhance the production of bigger fat globules that render the product less stable, (2) passing freshly extracted milk through vibratory sieves (150 microns) so as not to contain more than 0.5 per cent finely suspended solids (Adair and Marter, 1982). The use of centrifugation to remove excessive suspended solids results in the loss of coconut flavor and removal of sugars, proteins and other constituents that gives the characteristics sweet nutty flavor of coconut (Gonzalez, *et al.*, 1971); (3) immediate pasteurization of milk not exceeding 2 hours after extraction to prevent microbial spoilage and chemical deterioration. Coconut proteins coagulate at 81°C (Tejada, 1973) so that pasteurization procedure must be done carefully to avoid denaturation of proteins; (4) two-stage homogenization at 1,000 and 2,000 psi or 3,500 and 500 psi

for greater stability of milk (Timmins and Kramer, 1977, del Rosario and Punzalan, 1979) and (5) addition of recommended emulsifiers/stabilizers such as 0.5 per cent polyoxyethylene sorbitan monostearate (Timmins and Kramer, 1977), 0.5 per cent sodium caseinate for coconut milk containing high fat, and combination of 0.05 per cent sodium caseinate, 0.5 per cent sodium phosphate and 1 per cent ATMOS 150, a mixture of mono- and di-glycerides (Genato and Gonzalez, 1985), 0.5 per cent sodium stearoyl lactate, triodan 55, a polyglycerol ester and soy lecithin (0.25 per cent triodan and 0.1 per cent lecithin and 0.2 per cent xanthan gum). These emulsifiers produce stable coconut milk that is homogenous, milky white and free from coagulated materials. The UHT aseptic packaging system is recommended for processing coconut milk to be able to retain the white color and natural flavor and aroma of the freshly extracted coconut milk.

Processing of frozen coconut milk product requires pasteurization at 80°C for 30 minutes, packaging through a sanitized filling machine and pre-cooled as rapidly as possible in cold water, chilled at 5-10°C, and blast frozen at -18°C. Storage temperature must be maintained at -14° to -18°C. Freezing preservation requires strict sanitation practices and proper storage temperature for safety of the product. You may recall in 1991 that frozen coconut milk used in the preparation of rice pudding toppings and frozen coconut candy were found to contain cholera organism (*Vibrio cholerae*) that caused severe diarrhea in Maryland, USA consumers. This

organism was found to be resistant to freezing preservation.

Sweetened coconut milk concentrates such as jam, honey, and syrup have problem of oil separation and sugar crystallization. This is prevented by including in the formulation, glucose or corn syrup, to substitute a part of the total sugar requirement and citric acid for stability of the product.

Sweetened condensed milk made out of the coconut skim milk needs also formulation adjustment. In particular, the protein content must be raised by fortification with powdered dairy skim milk in order to satisfy the quality standard of the product. Similarly, the total soluble solids content must have to be adjusted with sugar to have a final value of approximately 68 per cent. In addition, coconut cream and corn oil must be added in the formulation. The mixture must be thoroughly homogenized before processing in a steam-jacketed kettle. It is also important to stir the mixture constantly to have a smooth texture.

In the case of coconut fermented milk products, there are three types, namely cheeses, yoghurt and cultured skim milk beverage. The quality control requirements for processing of these products are almost similar. These are the careful preparation of the coconut formulation, right strain of microorganisms used as starter culture (*Streptococcus lactis* and *S. diacetylactis* for white soft cheese; *S. cremoris* and *S. lactis* for Cheddar and cheese spread; *S. cremoris*, *S. diacetylactis*, and *Penicillium roqueforti* for blue-type cheese; *Lactobacillus bulgaricus* for



cultured skim milk; *Streptococcus thermo philus* and *L. bulgaricus* for yoghurt-type); optimum fermentation conditions, sanitary practices during processing operations and proper storage of the products.

In the manufacture of commercially acceptable coconut milk powder, high fat content of coconut milk must be avoided. The fat easily separates upon heating and insoluble proteins in coagulated portion are formed. Coconut powdered milk with high fat content easily turn rancid and the product is not free-flowing. During formulation, minimal amount of casein must be blended into fresh cream to improve the fluidity of the final product (Hagenmaier, 1983). The blended mixture must be dehydrated up to 0.8-2.0 per cent moisture by either passing directly to spray drying or straight through spray drier. Upon cooling the powdered product must be immediately packaged in moisture-proof container.

Nata de Coco: The quality and yield of *nata* produced depends largely on the quality of the coconut, other ingredients, starter culture and environmental conditions prevailing during *nata* formation. The process does not require heating of the medium and is biological in nature hence requires strict observance of sanitary procedures. All equipment, utensils and fermentation trays must be cleaned and sanitized. Processing areas should always be kept clean. In addition, the fermentation area should be devoid of insects, rodents, roaches and microorganisms that might contaminate the production

process. Personal hygiene must be emphasized to all workers.

The formulation for commercial production of *nata* is based on weight and volume measurements. As such, it was so calculated that the right conditions and nutrients for the active growth and cellulose production of the *nata* organisms are provided. Careful measurement of the ingredients called for in the formulation should be done. Similarly, optimum conditions for the growth and cellulose production must be provided such as culture medium with 7-8 per cent sugar, 1.5-1.8 per cent acetic acid and pH of 3.5-4.0, temperature of incubation at 28-32°C, relative humidity of 70-80 per cent and good aeration. The fermentation trays must be of the optimum size and when filled-up with growth medium should not be moved nor have any vibration of any sort to avoid formation of thin multi-layered *nata*.

Coconut water and sap products: Coconut water and sap of the unopened spathe are transformed into alcoholic and non-alcoholic beverages, and vinegar products. The sap can also be processed into sugar, honey and syrup. These products are mostly produced in small scale operation thus strict quality control procedures are difficult to observe. In case of the coconut water beverage, one food establishment in the Philippines is commercializing its manufacture. The control points being followed are the aseptic collection of the coconut water from the desiccated coconut factory, reduction of the fat content and strict temperature control during processing.

Tender nuts: The processing of the tender nut involves the removal of the large portion of the husk using mechanical device. Due to the high tannin content of the husk, the exposed portion turn brown easily thus affecting the acceptability to the consumers. Freshly trimmed nuts must be immediately immersed in sodium metabisulfite solution (2000 ppm) for 5-10 minutes before wrapping with cling-on plastic sheet so that the white color of the husk can be maintained for one week or longer if stored in a cool place (5-10°C). Another method of processing tender nut was observed in Thailand. The method consists of burning of the husk until only one fourth portion remains. The husk of the nuts are cleaned-off to expose the shell with patches of dark brown or black color due to the burning process. The cooked meat and the water taste sweeter than the unburned ones. It was claimed that this type of product has health and medicinal values.

Quality specifications for coconut products

Acceptability of different food products vary among countries, therefore, food processors has to modify the standard formulation to suit the local taste. Besides the acceptability aspect, processors should also pay attention to the need to satisfy the existing local quality standards and food laws that govern specific products.

What the market dictates as to quality and price and the consumers' preferences must be taken into consideration to be able to move the products manufactured. Generally people choose the food they eat in response to many influences such as



those that are detected by their senses (appearance, texture and flavor) and those that involve nutrition, sanitation, safety, and keeping qualities. Among these factors, the-most recent requirement in processed foods is the nutritional content of the product. Product labeling law now requires the manufacturers to state the nutrition facts per serving and per container of the product. This requirement enables the consumers to assess the food they purchase for both economic and health reasons.

These developments in food manufacture directly affect the products from coconut. There is a need therefore, for coconut food product manufacturers to have a balanced operations throughout the production, manufacturing, and distribution process for the products to compete in the global market. Quality must not be sacrificed for the price of the product since low quality product always face rejection by the consumers. Specifications for quality must therefore be met for the product to survive the strong competition in the world market.

Based on the present quality requirements of the market, some of the coconut food products specifications are given. The specifications for the aqueous coconut products are not included hence the reader is referred to the APCC Quality Standards for Aqueous Coconut Products (1997).

1. Unsweetened Desiccated Coconut : Hygienically dried coconut kernel with sodium bisulfite added to retain whiteness.

Physical characteristics:

- Color : White, free from yellow specks and other discoloration
- Flavor : Mild, fresh, characteristics of coconut with no off-flavors
- Odor : Characteristic coconut odor
- Size : Medium granules of coconut

Granulation: When 100 grams of sample is shaken for 5 minutes on a Rotap machine equipped with the following sieves:

US Standard Sieve No.	Percent Retained
60.	0
10	16.0 max.
16	75.0 max.
20	7.0 max.
Pan	2.0 max.

Chemical Specifications:

- Moisture : 3.8 per cent max.
- Total Fat : 67.0 to 71.0 per cent dry basis
- Free Fatty Acid : 0.15 per cent as oleic, max.
- pH : 6.1 to 6.7
- Residual sulfite (ppmSO₂) : 50 to 75 ppm (09750H) 150 ppm (09750)

Microbiological Specifications:

- Standard Plate Count : 5,000 per gram, max.
- Coliform Group Count : < 3 per gram MPN
- Yeast : 100 per gram, max.
- Mold : 100 per gram, max.

Staphylo- : 100 per gram, max.
coccus (c.p.)

Escherichia : None detected
coli

Salmonella : None detected

Packaging : Multiwall Kraft paper bag with 3-mil polyethylene liner 100 Ibs (PN 09750); 50 Ibs. (PN 097555); 25 Ibs. (PN 097522)

Storage : Store on pallets or dunnage, in odor-free area, out of sunlight, away from walls. Recommended temperature and humidity for maximum shelf life, 55 +/- 5°F, 50 per cent RH

Shelf life : 18 months under ideal storage conditions.

2. Special Creamed Coconut: Unsweetened desiccated coconut ground to semi-solid consistency. Not stabilized. Sodium metabisulfite (to retain whiteness)

Physical Characteristics:

- Color : Creamy white
- Flavor : Characteristic of coconut (mild and sweet) with no off flavors
- Granulation : Wet Sieve Test: 25 grams sample dissolved in 500 ml hot water

US Standard Screen No.	No. of Particles Retained
18	0
20	5 max.

Chemical Specifications:

- Moisture : 30 per cent maximum
- Total Fat : 67.0 to 71.0 per cent



Free Fatty Acid : 0.15 per cent as oleic, maximum
pH : 6.1 to 6.7
Residual sulfite, (ppm SO₂) : 50 maximum (PN.08599-56606H)
150 maximum (PN 08599-56608)

Microbiological Specifications:

Standard Plate Count : 5,000 per gram, maximum
Coliform : < 3 per gram, MPN
Yeast : 100 per gram, maximum
Mold : 100 per gram, maximum
Staphylococcus (c.p.) : 100 per gram, maximum
Escherichia coli : None detected
Salmonella : None detected

Packaging: 50 lbs net in white plastic pail; 50 lbs net in multilayer bag in box

Storage: Store on pallets or dunnage, in odor-free area, out of sunlight and away from walls. Recommended temperature and humidity for maximum shelf life: 55 +/- 5°F and 50 per cent RH.

Shelf Life: 12 months under ideal storage conditions

3. Powdered Coconut Milk:
White and free-flowing, no rancidity

Food energy (calories) : 692
Fat (per cent) : 60.5
Carbohydrates (per cent) : 27.25

Protein (per cent) : 9.6
Ash (per cent) : 1.75
Crude fiber (per cent) : 0.02
Moisture (per cent) : 0.8-2.0
4. Coconut Flour: White, fine, free-flowing
Moisture (per cent) : 2.0-5.0
Ash (per cent) : 4.0
Oil (per cent) : 1.4
Protein (per cent) : 12.0-15.0
Total carbohydrates (per cent) : 55.0-70.0
Crude fiber :
60 mesh screen : 10.7
115 mesh screen : 4.5

Nata de Coco in syrup:
Philippine National Standard Specification (PNS 1219:1994) - This standard specifies requirements and methods of test for nata de coco in syrup packed in hermetically-sealed container.

Definitions:

Raw nata de coco - thick, white, translucent and gel-like mass produced by the bacteria, *Acetobacter pasteurianus* (*Acetobacter aceti* subsp. *xylinum*), during fermentation of coconut substrate.

Equilibrium pH - The pH of the thoroughly comminuted contents of the product container. This represents the pH of the product at equilibrium (taken not less

than 7 days from date of production) or after the exchange of acids between the various components of the product has stabilized.

Total soluble solids (TSS) - The measure of sugar and other soluble solids expressed in degree Brix (°B).

Translucent - Partially transparent, having the property to allow light to pass through.

Off-odor - Fermented, rancid, and other unacceptable odor.

Off-color - Any discoloration not characteristic of the product.

Texture - Firmness of *nata* both raw and processed measured by using a potentiometer or its equivalent.

Drained weight- The mass of solid food in a container.

Filth and extraneous matter - Any objectionable matter contributed by animals such as rodent, insect or bird or any visible matter not inherent to the product.

Classification:

Nata de coco in syrup - The product consisting of uniformly cut pieces of nata de coco packed in syrup with or without food additives, i.e. acidulants, preservatives, food colors or flavors.

Acidified nata de coco in syrup - The heat-processed product with an equilibrium pH of less than 4.6 and packed in hermetically sealed container.

Low-acid nata de coco in syrup - The heat-processed product with an equilibrium pH greater or



equal to 4.6 and packed in hermetically sealed container.

Requirements:

A. Syrup Strength (expressed in TSS)

Extra light syrup - not less than 10°B: 10° to below 14°B

Light syrup - not less than 14°B: 14° to below 18°B

Heavy syrup - not less than 18°B: 18° to below 22°B

Extra heavy syrup - not less than 22°B: 22°B and above.

Note: Cut-out strength of syrup is to be determined on sample average, but no container shall have a total soluble solids (TSS) value by +/1°B of the specified syrup strength.

B. Food Additives - Food additives when used shall be in accordance with the regulations of the Bureau of Food and Drugs.

Acidulants Allowable Level (MAL)

Citric acid	GMP
Ascorbic acid	GMP
Fumaric acid	GMP
Lactic acid	GMP
Malic acid	GMP

Preservatives (for acidified products only)

ADI x 40

Sorbates, mg/kg, max. 25x40=1000ppm

Benzoate, mg/kg, max. 5 x 40 = 200ppm

Note: Combined level shall not exceed 1000 mg/

Sulfites (SO₂), mg/kg, max. 0.7 x 40 = 28ppm

Food color :As specified in BFAD regulations

Flavors : GMP

C. Physical

1. Nata de coco shall have a translucent and smooth appearance. It shall have no acetic acid odor and other off-odors and color. Texture shall be firm with a potentiometer reading of greater or equal to 7.0 mm .

2. The minimum fill shall not be less than 90 per cent of the water capacity of the container. The minimum weight of the product shall not be less than 60 per cent of the actual net weight. Each container should have uniform-sized nata de coco pieces.

D. Microbiological

Molds, yeasts and bacteria if present shall conform to the microbiological requirements as shown in Table 2 when tested in accordance with the specified test methods.

Table 2. Microbiological limits

Test	Limit
<u>For acidified nata de coco:</u>	
Aerobic Plate Count (cfu/g, max.)	100
Molds and Yeast (cfu/g, max.)	10
<u>For low acid nata de coco:</u>	
Commercial sterility test	pass

E. Hygiene

Nata de coco in syrup shall be prepared under hygienic conditions in accordance with PNS 96.

Process requirement: Nata de coco in syrup shall be heat-processed for adequate length of time after

packing into bottles, cans or retortable pouches, to prevent spoilage when held at ambient temperature. Low acid nata de coco shall be processed with the appropriate process schedule to attain commercial sterility.

To the extent possible in GMP, the product shall be free from objectionable matter. The presence of unavoidable filth and extraneous matter is specified in Table 3.

F. Sampling

A lot shall consist of products manufactured in one production shift, under similar processing conditions.

Samples shall be taken in accordance with PNS 466/ISO 2859.

G. Packaging

Nata de coco shall be packed in hermetically-sealed containers suitable for food contact use.

H. Marking and Labeling

Each container shall be labeled and marked with the following information:

1. The name “**Nata de Coco in Syrup**”
2. Name and address of manufacturer
3. List of ingredients and food additives in descending order of proportion. Sulfites when present at 10 ppm or more shall be declared.
4. Net mass in metric units
5. Lot or code number
6. Date of manufacture/Best before date
7. The words “**Product of the Philippines**”



Table 3. Tolerance for visible filth and extraneous matters.

Type of visible filth and extraneous matters	Cooked nata de coco	
	< 1 kg	> 1 kg to 4 kg
Hair, whole insects, recognizable insect parts, feather fragments	absent	absent
Extraneous materials (> 1.00 mm)	absent	absent
Extraneous materials, less or equal to 1.00 mm (e.g. coconut husk fibers, wood particles)	not more than 2 pcs.	not more than 5 pieces
Other extraneous materials or other	not more than 10per cent w/w of the drained nata pieces	not more than 10 per cent w/w of the drained nata pieces
	and/or	and/or
	not more than 10 particles per 500 ml of medium	not more than 10 particles per 500 ml of medium
Textile fibers	not more than 5 pcs.	not more than 5 pieces

Processing and Packaging. The new concept of processing food is the so-called ultra high temperature-short time (UHTST) processes being employed mostly in liquid products. In addition, changes in the food industry were initiated with regards to the use of environmentally acceptable ways of packaging foods and disposing of wastes.

Conclusion

To produce top-quality coconut-based food products, it is absolutely essential that quality standards be established and strictly adhered to by the industry and government agency concerned. These standards must constantly be observed not only in the process but also with regard to raw materials and ingredients, specifications and storage which can easily downgrade a product if neglected.

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