PHILIPPINE NATIONAL STANDARD

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Recommended code of practice for the processing and handling of mango beverage products

BUREAU OF PRODUCT STANDARDS

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Foreword

This project is a continuation of the development of ethnic food products composed of the Technical Working Group (TWG) of different agencies and industry groups namely the Industrial Technology Development Institute (ITDI) of the Science and Technology (DOST), Bureau of Food & Drugs (BFAD) of the Department of Health (DOH), Bureau of Agriculture and Fisheries Product Standards (BAFPS), Bureau of Product Standards (BPS), Bureau of Export and Trade Promotions (BETP) and Food Products Division of the Department of Trade and Industry (DTI), Philippine Chamber of Food Manufacturers Incorporated (PCFMI) and Integrated Food Manufacturers Association of the Philippines (INFOMAPP).

The Philippine Council for Industry and Energy Research (PCIERD) of the DOST is the financing agency while the Philippine Food Processors and Exporters Organization, Inc. (PHILIFOODEX) signifies as the collaborating agency and the Department of Food Science and Nutrition (FSN) of the College of Home Economics, University of the Philippines as the implementing agency.

The TWG main task is to draft standards and codes of practice for identified ethnic food products which will be later adopted as national standards after a series of reviews and public consultation in coordination with the Bureau of Food and Drugs.

To gather more inputs from the big players of these mango beverage products the public consultation was held in Cebu City of the Center for Health Development – Central Visayas. From the public consultation, concerns of food processors were raised and clarified as to the standards of the product.

In the development of this standard, Codex General Standard for Fruit Juices and Nectars, Codex Stan 247-2005 was considered.

Recommended code of practice for the processing and handling of mango beverage products

1 Scope and purpose

This Code of Practice is concerned with the receipt of raw materials and ingredients, preparation and processing of mango beverage products as defined in this Code, in order to conform with the required standards stated in PNS/BFAD 09:2007 Standards for Mango Beverage Products. The product may be prepared from different varieties of mango (*Mangifera indica* L.) used for mango beverage processing.

This Code is intended to provide guidelines to achieve compliance with the standards for mango beverage products packed in any suitable containers.

2 Definition of terms

For the purpose of this Code, the following definitions apply:

2.1
acid food
it is any food that has a natural pH of 4.6 or below

2.2
acidified low-acid food
it is any food that has been treated so as to attain an equilibrium pH of 4.6 or lower after processing

2.3
Brix
It is the concentration of sugar in syrup corresponding approximately to concentration of solutes expressed in percentage as measured with a refractometer or hydrometer and expressed in °Brix units

2.4
container
it is any form of packaging material, which completely or partially encloses the food (including wrappers). A container may enclose the food as a single item or several units or types of prepackaged food when such is presented for sale to the consumer

2.5
current good manufacturing practices (cGMP)
a quality assurance system aimed at ensuring that products are consistently manufactured, packed or repacked or held to a quality appropriate for the intended use. It is thus concerned with both manufacturing and quality control procedures

2.6
hermetically sealed container
it is a container which is airtight sealed to protect the contents against the entry of microorganisms during and after heat processing

2.7
food
it is any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or substances used only as drugs

2.7
food additives
it is any substance the intended use of which results or may reasonably be expected to result, or indirectly, in its becoming a component or otherwise affecting the characteristics of any food (including any substance intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding of food; and including any source of radiation intended for any such use), if such substance is generally recognized, among experts qualified by scientific training and experience to evaluate its safety, as having been adequately shown through scientific procedures to be safe under the conditions of the intended use

2.8
food standard
it is a regulatory guideline that defines the identity of a given food product (i.e. its name and the ingredients used for its preparation) and specifies the minimum quality factors and, when necessary, the required fill of the container. It may also include specific labeling requirements other than or in addition to the labeling requirements generally applicable to all prepackaged foods

2.9
i**ngredient**
it is any substance including food additive, used as a component in the manufacture or preparation of a food and present in the final product in its original or modified form

2.10
label
it includes any tag, brand, mark, pictorial, or other descriptive script, written, printed, marked, embossed or impressed on, or attached to the container

2.11
labelling
it is any written, printed or graphic matter (1) upon any article or any of its container or wrappers and/or (2) accompanying the packaged food

2.12
lot
it is food produced during a period of time and under more or less the same manufacturing condition indicated by a specific code

2.13
mango syrup
it is liquid resulting from the dehydration process of mango using sugar as the osmotic agent. It may contain other food additives

2.14
p**ackaging**
it is the process of packing that is part of the production cycle applied to a bulk product to obtain the finished product. Any material, including painted material, employed in the packaging of a product including any outer packaging used for transportation of shipment. Packaging materials are referred to as primary or secondary according to whether or not they are intended to be in direct contact with the product

2.15
pasteurization
it is the heating of food at 100 °C or below at a specified period of time

2.16
pH
it is the intensity or degree of acidity of a food material.

2.17
potable water
it is the water fit for human consumption and potability determined by health authorities cited in Philippine National Standards for drinking water (PNS 991:1993, Agricultural and Other Food Products – Bottled Drinking Water – Specifications)

2.18
pulpy product
it is a blend of total edible sieved or ground or homogenized, sound, ripe fruits

2.19
refractometer
it is the instrument used to measure the percent soluble solids of sugars referred to as degree Brix (°Bx); concentration of sugars expressed in terms of number of grains of sucrose per 100 g of liquid

2.20
sweetening agent
it is a carbohydrate including one or more of the sugars, honey, high intensity sweeteners and artificial sweeteners

3 Raw materials , ingredients and packaging material requirements

3.1 Raw materials and ingredients

Raw materials for processing shall not contain parasites, microorganisms, toxins and decomposed or extraneous substances.

3.1.1 Mango

Mango to be used for processing shall be prepared from sound, clean, mature fruit and is of a quality fit to be sold fresh for human consumption.

3.1.2 Water

Only clean, potable water (Annex A) shall be used for the preparation and for all the pretreatment and processing steps.

Non-potable water may be used only for operations not in direct contact with the food materials provided that this does not pose a hazard to health as determined and approved by the official agency having the jurisdiction over it.

3.1.3 Sweetening agent

Sweetening agent or agents to be used shall conform to food standards required by the Bureau of Food and Drugs (BFAD), the Codex Alimentarius Commission and/or authority for these products.

3.1.4 Food additives

All additives including acidulants, humectants, coloring and flavoring agents shall conform to the food standards required by BFAD. They shall be properly packaged and stored.

3.2 Packaging materials

The packaging materials should be appropriate for the product to be packed and for the expected conditions of handling during distribution and storage. These should provide the products adequate protection from contamination and should be sufficiently durable to withstand mechanical, chemical and thermal stresses encountered during heat processing and normal distribution. All packaging materials must be clean and free from defects that may affect the product or package integrity. These shall be stored in a clean and sanitary manner.

Before filling, rigid containers shall be cleaned to prevent incorporation of foreign matter into the finished product. Closures, semi-rigid containers, preformed flexible pouches and roll stock contained in original wrappings may be cleaned before use, subject to the conditions of handling by the processors or suppliers.

3.2.1 Glass jars and metal closures (caps or lids)

Only heat resistant glass jars and metal closures shall be used. The glass jars shall be properly inspected for presence of cracks, chips and other defects. These must be washed with clean water to eliminate dirt and foreign matter. Metal closures shall be provided with heat resistant liners and must be free from scratches, dents and other defects. It must also be provided with a sealing compound that will effect a hermetic seal after thermal processing.

Glass jars may be reused provided they are sound, and properly washed and sanitized. All metal closures shall never be re-used. Shrinkable plastic cap seals, when used, should fit the size of the closures and glass jars, to prevent tampering and to provide protection from bottleneck contamination and other physical damage.

3.2.2 Metal containers

Two- or three-piece metal cans shall be inspected for integrity of side seam and double seams, general cleanliness and presence of defects. The double seams shall be examined for gross closure defects such as cutover or sharpness, skidding or deadheading, false seam, droop at the crossover or lap, and condition of inside of countersink wall for evidence of broken chuck. If necessary, suitable inside lacquer or coatings may be used as required by the product. Closure of these containers must have adequate sealing compound to make the double seam a hermetic seal after thermal processing.

3.2.3 Semi-rigid and flexible containers

Preformed containers may be used provided they are suitable for the product. These shall be free from pinholes, scratches, blisters and gross closure defects that may affect the integrity of the package. The seal area must be free from contamination and wrinkles and shall provide a hermetic seal upon closure.

4 Hygiene

It is recommended that the product covered by the provisions of this code of practice be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1 – 1969, Rev 4 (2003)) and/or the BFAD A.O. No. 153 s. 2004 - Guidelines, Current Good Manufacturing Practices in Manufacturing, Packing, Repacking or Holding Food, covering the plant facilities and operations requirement including the construction and layout of processing plant, hygienic facilities, equipment, utensils and working surfaces.

5 Preparation and processing of mango beverage products

The preparation of mango beverage products is described separately from the receipt of raw materials until the pre-filling operations.

5.1 Preparation of raw materials for mango beverage processing

5.1.1. Mango

5.1.1.1 Receipt of raw materials

Mango fruit shall only be accepted if it is sound and suitable for processing. Those that show signs of deterioration shall not be used.

5.1.1.2 Inspection and sorting

Prior to processing, the mango fruit shall be inspected and sorted according to size and quality before processing (PNS/BAFPS 13:2004 Philippine National Standard. Fresh Fruit Mangoes - Specification). Sorting may be carried out on moving inspection belts or sorting tables.

5.1.1.3 Washing and/or cleaning

Mango fruit is washed to remove dust, dirt, insect, mold spores, plant parts and filth that might contaminate or affect its color, aroma or flavor. To be most effective and economical, washing with water must be accompanied with brushing, rubbing and forcing the water against the fruit and into crevices. Detergents are frequently used in the wash or rinse water.

5.1.1.4 Peeling, slicing and separation of edible portion (stone removal)

These steps shall be done as soon as possible to prevent contamination.

5.1.1.5 Pulping/finishing

Pulping is the extraction of the juice from the mango flesh. This is done by passing the mango flesh through a pulping/finishing machine with metal screens or sieves.

5.1.1.6 Mixing/blending of other ingredients

Water, prepared syrups or sweetening agent or agents, food additives and other components for the preparation of the intended mango beverage product are added to the finished mango flesh.

5.1.1.7 Other treatments

Other treatments such as filtration, deaeration, enzyme treatment and juice clarification can also be carried out prior to pasteurization.

For powders, the concentrated formulated juice is subjected to juice dehydration systems such as vacuum, spray, drum and freeze systems.

5.2 Acidification process

To produce products with a pH of 4.6 or less, acidification must be properly carried out (Annex B). It is important that perishable ingredients must not be contaminated before acidification and until equilibrium pH of 4.6 or less is reached.

5.3 Pasteurization

The formulated mango beverage product is subjected to pasteurization where it is heated at 100 °C or below at a specified period of time.

5.4 Filling of containers

The filling of containers, either mechanically or manually, shall be controlled so as to meet the filling and headspace requirements specified in the process schedule. It is important to standardize filling, not only for economic reasons, but because the heat penetration and the container integrity may be affected by excessive fill variation. Properly filled containers must result in cut-out net weight equivalent to at least 90% of the water capacity of the container. Overfilling can lead to contamination of seals which can affect container integrity.

The food material may be packed hot or cold into containers. Glass containers for hot filling may be dipped in hot water before filling to prevent thermal shock or breakage. During filling, contamination of sealing areas with product must be avoided. They must be kept clean and dry to obtain a satisfactory closure.

5.5 Exhausting of filled containers

Exhausting of filled containers shall be controlled to create the necessary vacuum upon cooling. It also prevents and minimizes corrosion of closures and removes air that would cause loss of color, flavor and vitamins. This may be done by heat exhausting, hot filling, steam injection or mechanical/vacuum exhausting.

During heat exhausting, the temperature of the contents must reach at least 65 °C (150 °F). This would be sufficient to produce vacuum readings of 8 psi - 12 psi (equivalent to 5.5 inch Hg - 13.6 inch Hg or 18.6 kPa - 46.2 kPa) in the finished product.

5.6 Closing or sealing of containers

Seams and other closures shall be sealed air-tight to meet the requirements of the processors.

Self-sealing metal caps or lids shall be tightened and secured to each filled container before thermal processing. No further tightening shall be done during and after processing to avoid breaking the seal that could result to leakage.

To prevent leakage and contamination, the sealing surface shall be free of defects and damage. After closing, the caps must be essentially level, not cocked or tilted, and seated well down the finish. This will prevent damage caused by bumping of adjacent containers as they move along conveyors.

The pouch seal area must be free of food material and wrinkles. Sealing temperature, pressure and dwell time shall conform to the packaging material specifications.

5.7 Coding of sealed containers

Coding of sealed container shall be indelible with details of production date and time, batch code, product code, the product line in which product is packed, the manufacturing plant and other information necessary for product traceability. Where the container does not permit the code to be embossed or inked, the label shall be legibly perforated or otherwise marked, and securely affixed to the product container.

5.8 Washing of sealed containers

Where necessary, filled and sealed containers shall be thoroughly washed before sterilization to remove grease, dirt and product from the outside of the container.

5.9 Cooling of processed products

Cooling of finished products must be done promptly until a temperature of 40 °C - 43 °C is reached. Air-cooling is recommended for products in glass containers.

Cooling water must be of low microbial content, which can be achieved by adequate chlorination. The level of residual free chlorine for cooling water after its use must be 0.5 ppm – 2.0 ppm. Chlorine levels in excess of this may accelerate corrosion of certain metallic containers. Residual chlorine levels in cooling water shall be monitored and recorded.

5.10 Post-process container handling

Mechanical and thermal shocks leading to leaker infection and breakage of glass containers due to container abuse must be avoided. These occur by knocking against each other during conveying, in-place cooling, packaging and labeling operations, among others.

Before unloading crates, water must be drained from container surfaces by tilting the crates as far as possible and allowing sufficient time for the water to drain. Processed containers shall not be manually handled while wet.

Pouches shall be handled singly rather than in bunches, and care must be exercised so as to prevent damage by roughened contact surfaces.

6 Food additives

Food additives when used shall be in accordance with the regulations established by the Bureau of Food and Drugs (BFAD) (Bureau Circular No. 016 s. 2006. Updated List of Food Additives), the Codex Alimentarius Commission and/or authority for these products. The following food additives listed in, but not limited to, Table 1, may be used for the manufacture of mango beverage products.

7 Post-process handling procedures

To control post-process leakage contamination or leaker infection in glass containers and cans, processed containers shall be dried as soon as possible after processing so that exposure to post-wet retorting, conveying and handling equipment is minimized.

8 Inspection and labelling

8.1 Inspection of finished products

All processed products shall be inspected before labeling and casing and defective products shall be withdrawn or rejected. The company must have an approved policy and

procedures based on the BFAD A.O. No. 153 s. 2004 - Guidelines, Current Good Manufacturing Practices in Manufacturing, Packing, Repacking or Holding Food.

Table 1 - Food Additives for Fruit Juices*.
(BFAD B.C. No. 016 s.2006. Updated List of Food Additives)

Function	Food additive	Function	Food additive
Acidity regulator	1. Citric acid 2. Malic acid 3. Calcium carbonate	F. Processing Aids	a. Antifoaming agent - Polydimethylsiloxane b. Clarifying agents/Filtration aids/Flocculating agents - Adsorbent clays, Adsorbent resins, Activated carbon(only from plants),Bentonite, Cellulose, Chitosan, Colloidal silica, Diatomaceous earth, Gelatin (from skin collagen), Ion exchange resins (cation and anion), Kaolin, Perlite, Polyvinylpolypyrrolidone, Rice hulls, Silicasol, Tannin c. Enzyme preparations – Pectinases (for breakdown of pectin), Proteinases (for breakdown of proteins), Amylases (for breakdown of starch), Cellulases (limited use to facilitate disruption of cell walls) d. Packing gas – nitrogen, carbon dioxide
Anticaking agent	1. Calcium aluminum silicate (Synthetic) 2. Microcrystalline cellulose 3. Aluminum silicate 4. Carnauba wax		
C. Antioxidant	1. Ascorbic acid 2. Calcium ascorbate 3. Erythorbic acid 4. Potassium ascorbate 5. Sodium ascorbate 6. Sodium erythorbate		
D. Colour	1. Carotenoids 2. Chlorophylls, Copper complexes 3. Curcumin 4. Riboflavin 5. Sunset Yellow 6. Tartrazine		
E. Preservative	1. Benzoates 2. Hydroxybenzoates 3. Sorbates 4. Sulphites 5. Carbon dioxide 6. Phosphates	G. Stabilizer/ Thickener	1. Calcium chloride 2. Carob bean gum 3. Carrageenan 4. Gellan gum 5. Guar gum 6. Gum arabic 7. Karaya gum 8. Lactic and fatty acid esters of Glycerol 9. Pectins 10. Potassium alginate 11. Sodium alginate 12.Tara gum 13. Tragacanth gum 14. Xanthan gum 15. Agar 16. Konjac glour 17. Sodium carboxymethylcellulose
		H. Sweetener	1. Acesulfame potassium 2. Aspartame 3. Saccharin 4. Sucralose

* Based on the Food Category System: 14.1.2.1 Canned or bottled (pasteurized) fruit juice, 14.1.2.3 Concentrates (liquid or solid) for fruit juice, 14.1.3.1 Canned or bottled (pasteurized) fruit nectar and 14.1.3.3 Concentrates (liquid or solid) for fruit nectar.

8.2 Labelling

Labelling shall be done after the prescribed incubation period when the product has passed quality evaluation. All containers shall be properly labeled. The label shall conform to the rules and regulations of BFAD.

8.3 Tamper-evident seals

Tamper-evident seals are highly recommended.

9 Quality assurance

9.1 Record keeping

Permanent and legible dated records of time, temperature, code mark and other pertinent details shall be kept concerning each load. Such records are essential as a check on processing operations.

Record of time steam on, time and temperature, time sterilization temperature reached and time steam off shall be kept concerning each load.

Written records of all container closure examinations shall specify the code lot, the date and time of container closure inspections, the measurements obtained and all the corrective actions taken.

Records shall be maintained identifying initial distribution of the finished product to facilitate, if necessary, the segregation of specific food lots that may have been contaminated or otherwise unfit for intended use.

9.2 Deviations in processing

Whenever in-process monitoring records disclose that a product has received a thermal or processing treatment less than that stipulated in the scheduled process, the processor shall:

9.2.1 Identify, isolate and then reprocess that portion of the production involved. Complete reprocessing records shall be retained; or

9.2.2. Set aside that portion of the product involved for further evaluation as to any potential public health significance. Such evaluation shall be made by competent processing authority and shall be in accordance with recognized procedures. A record shall be made of the evaluations made and the results. After the determination that no significant potential for health hazards exists, that portion of the product involved may be distributed. Otherwise, that portion of the product shall be destroyed.

All process deviations involving failure to satisfy the minimum requirements of the process schedule shall be recorded detailing those deviations and the actions taken.

9.3 Hazard analysis and critical control points (HACCP)

HACCP plan must be developed for each product. Prior to the development of HACCP plan, establishments shall have developed, documented and implemented prerequisite programs based on BFAD's Current Good Manufacturing Practices (cGMP) and Hygiene Control.

Guidelines for the Application of the Hazard Analysis Critical Control Point (HACCP) System (CAC/GL 18-1993) present the recommended sequence and document formats for the application of the HACCP systems.

10 Storage and transport of finished products

Storage and transport conditions of the finished product shall be such that the integrity of the product container, and the safety and quality of the product are not adversely affected.

Cases and cartons must be thoroughly dry. They must be of proper size so that the containers fit snugly and are not subject to damage from movement within the case. They must be strong enough to withstand normal transport.

Extreme temperature fluctuations during storage and transport of the product must be avoided to prevent product deterioration.

11 Laboratory control procedures

Each food processing establishment shall have access to laboratory control of both the processes used and the finished products. All food ingredients and food products declared unfit for human consumption by the laboratory shall be rejected.

Representative samples for each lot or batch shall be taken to assess the safety and quality of the product.

Microbiological laboratory shall be separated from the processing area. No pathogens shall be handled within the premises of manufacturing plant.
Laboratory procedures for quality control of the processes and the product must follow recognized or standard methods for easy interpretation of results.

12 End product specifications

Appropriate methods shall be used for sampling analysis and determinations to meet the following specifications:

12.1 To the extent possible in good manufacturing practices, the products shall be free from any objectionable characteristics.

12.2 The product shall not contain any pathogenic organisms or any toxic substances originating from microorganisms.

12.3 The product shall be free from chemical pollutants in amounts which may represent hazard to health.

12.4 The product shall comply with the requirements set forth by the Bureau of Food and Drugs (BFAD) and the Codex Alimentarius Commission on Pesticide Residues and Food Additives.

Annex A

Standard parameters and values for drinking water*

Table A.1 – Standard values for bacteriological quality

Source and mode of supply	Bacteria	Standard value (no./100mL)
All drinking water supplies under all circumstances (Level I, II, III bottled water and emergency water supplies)	*E.coli* or thermotolerant (fecal) coliform bacteria	0
Treated water entering the distribution system	*E.coli* or thermotolerant (fecal) coliform bacteria	0
Treated water in the distribution system	*E.coli* or thermotolerant (fecal) coliform bacteria	0
	Total coliforms	Must not be detectable in any 100 mL sample. In any case of large quantities where sufficient samples are examined, it must not be present in 95 % of samples taken throughout any 12-month period.

Table A.2 – Standard values for physical and chemical quality: aesthetic quality

Constituent maximum or characteristics	Level (mg/L)
Taste	Unobjectionable
Odor	Unobjectionable
Color	5 TCU
Turbidity	5 NTU
Aluminum	0.2
Chloride	250
Copper	1
Hardness	300 (as $CaCO_3$)
Hydrogen sulfide	0.05
Iron	1
Manganese	0.5
pH	6.5 – 8.5
Sodium	200
Sulfate	250
Total dissolved solids	500
Zinc	5

* Sec.2 **Philippine National Standards for Drinking Water**. Department of Health, Manila.

Annex B

Acidification procedures

To produce products which have a pH of 4.6 or less, acidification must be properly carried out. Here are some methods to obtain properly acidified foods:

B.1 Blanch the food ingredients in an acidified aqueous solution – Food particulates could be blanched in a hot acid bath. The ability to obtain a properly acidified product is dependent upon blanch time and temperature, as well as the concentration of acid.

B.2 Immersed the blanch foods in an acid solution – The product is blanched in the steam or water blancher, then dipped into an acid solution, removed from the acid solution and placed into containers. The proper acidification depends upon how well the product is blanched, concentration of the acid and contact time.

B.3 Direct batch acidification – Ingredients are mixed n a kettle, and acid is added directly to the batch. (An elevated temperature may improve the rate of acid penetration into solid particles.) The pH of the batch is checked before the material is filled in containers.

B.4 Add acid foods to low-acid foods in controlled portions – The acid food is mixed with the low-acid food to get an acidified food product. The proportion of acid food to low-acid food is important to obtain uniform and accurate control of pH of the finished product.

B.5 Directly add a predetermined amount of acid to individual containers during production – This involves addition of acid pellets, known volumes of fluid acid, or some other means of direct acidification of each container.

Reference: Gavin, A. and L.M. Weddig. Ed. 1995. **Canned Foods: Principles of Thermal Process Control, Acidification and Container Closure Evaluation**. 6th ed. The Food Processors Institute. 1401 New York Ave., N.W., Washington, D.C. 2005.

Annex C

Critical control points in the production of acidified foods

For proper production of an acidified shelf-stable product, these are some critical control points that should be checked to ensure that the acidification procedure is under control.

C.1 Every container of food must be acidified in the same proportions

a) When producing a solid-liquid mixture which will be acidified in the container by direct acidification, it is necessary to know and control the amount of solid material in each container. This permits the addition of the appropriate amount of acid to obtain a pH less than 4.6.
b) Know the buffering capacity of the food.
c) It is necessary to control the unit operations of peeling, blanching, exhausting, brining and closure. For example, some products are lye-peeled, and if the lye carry-over is not controlled, the product will have a higher initial pH than accounted for in the formulation. The end result will be a product that is not in control, and which has a higher pH value than required. The operations that, according to the process schedule, will affect the pH of the finished product must be controlled and recorded.

C.2 Monitor acidification by pH measurement before and after equilibrium. The key is that the finished product pH must be 4.6 or less. Finished product pH means the pH of the product (components included) in the final container after thermal processing – not the raw product pH. The pH measurements must be recorded and the records reviewed at the appropriate time intervals.

C.3 Monitor the scheduled thermal process. The objective of the thermal process is to destroy vegetative cells of microorganisms of public health significance and those of non-health significance capable of reproducing in the food under normal conditions of storage and distribution.

C.4 Container handling. Processed containers should be handled in such a manner as to minimize damage to the seals and/or product recontamination.

C.5 Products found to have an equilibrium Ph greater than 4.6 shall be reprocessed as low-acid food to render it safe, or destroyed.

Reference: Gavin, A. and L.M. Weddig. Ed. 1995. **Canned Foods: Principles of Thermal Process Control, Acidification and Container Closure Evaluation**. 6th ed. The Food Processors Institute. 1401 New York Ave., N.W., Washington, D.C. 2005.

Annex D

Processing using hot water bath (Boiling water canner)

D.1 Half fill the canner with very hot water.

D.2 Arrange the products to be processed on the rack. Add very hot water, if needed, to bring level up to 1 to 2 inches above container tops. Do not pour water directly on the containers to avoid breakage due to thermal shock. Place a tight-fitting cover on canner. If a pressure canner is used for hot water bath processing, leave the cover unfastened and the petcock open to prevent buildup of pressure.

D.3 Set a timer for recommended processing time after water comes back to a rolling boil. Keep water boiling gently and steadily. Add boiling water if necessary to keep jars covered.

D.4 Remove the containers from canner immediately when timer sounds.

Reference: www.eesc.orst.edu. Canning Tomatoes and Tomato Products.

Annex E

Determination of total soluble solids

E.1 Apparatus

a) Balance – With capacity of ≤2 kg and sensitivity of 0.1 g
b) High speed blender
c) Hand refractometer. – With scale reading of 0° - 35° Brix

E.2 Standardization of refractometer

Adjust instrument to read *n* of 1.3330 of 0 % sucrose with H_2O at 20°.

E.3 Preparation of sample

Mix representative aliquots of liquid and solid materials at same liquid-to-liquid ratio as original sample, and blend to workable paste.

Accurately weigh ca 10 g prepared paste, dissolve in equal amount of H_2O at 20 °C. Mix thoroughly.

E.4 Determination

Place sufficient amount of sample on the prism of the instrument, and determine by direct reading in terms of °Brix.

Calculation is simplified by multiplying Brix of solution by 2.

Annex F

Determination of alcohol in fruit products (By Volume from specific gravity)

F.1 Distillation of sample

Measure 100 mL original material into 300 mL - 500 mL distillation flask, noting temperature, and add 50 mL water. Attach flask to vertical condenser by means of bent tube, distill almost 100 mL, and dilute to 100 mL at same temperature before proceeding with distillation.

F.2 Calibration

Fill thoroughly cleaned pycnometer with recently distilled water, stopper, and immerse in constant temperature water bath with bath level above graduation mark on pycnometer. After 30 min, remove stopper and with capillary tube adjust until bottom of meniscus is tangent to graduation mark. With small roll of filter paper, dry inside neck of pycnometer, stopper, and immerse in water at room temperature for 15 min. Remove pycnometer, dry, let stand 15 min, and weigh. Empty pycnometer, rinse with acetone, and dry thoroughly in air with suction. Let empty flask come to room temperature, stopper, and weigh.

Weight of water = weight of filled pycnometer – weight of empty pycnometer

F.3 Determination of specific gravity at room temperature

a) Determine weight of sample as in B.

Weight of sample = weight of filled pycnometer – weight of empty pycnometer

b) Calculate specific gravity as follows:

Specific gravity = SW,

where

S is the weight of sample; and

W is the weight of water.

F.4 Determination of alcohol

Obtain corresponding % alcohol by volume from Appendix C: Reference Volumes 913.02. AOAC Manual. 16th ed.

Annex G

Microbiological examinations of mango beverage products

G.1 Media and reagents

a) **Tryptone broth (Aerobic medium)** – Dissolve 10.0 g tryptone or Trypticase, 5.0 g glucose, 1.25 g K_2HPO_4, 1.0 g yeast extract, and 2.0 mL 2 % alcoholic solution of bromcresol purple in 1 L H_2O with gentle heat, if necessary. Dispense 10 mL portions into 20 mm x 150 mm screw-cap test tubes and autoclave 20 min at 121 °C. Do not exhaust before using.

b) **Modified PE-2 medium (Anaerobic medium)** – Dissolve 20.0 g peptone, 3.0 g yeast extract and 2.0 mL 2 % alcoholic solution of bromcresol purple in 1 L H_2O with gentle heat, if necessary. Dispense 19 mL portions into 20 mm x 150 mm screw-cap test tubes containing 8-10 untreated Alaska seed peas (hardware store). Autoclave 30 min at 121 °C. If not freshly prepared, heat to 100 °C and cool to 55 °C before using.

c) **Glucose starch agar (Aerobic medium; Difco dehydrated [No.0001], or equivalent)** – Dissolve 15.0 g proteose peptone No.3, 2.0 g glucose, 10.0 g soluble starch, 5.0 g NaCl, 3.0 g Na_2HPO_4, 20.0 g gelatin and 10.0 g agar in 1 L H_2O, heat to boiling point, and autoclave 15 min at 121 °C in Erlenmeyer. Aseptically pour into sterile Petri dishes and allow to solidify.

d) **Nutrient agar (Aerobic medium for spore production; Difco dehydrated [No.0001], or equivalent)** – Dissolve 3.0 g beef extract, 5.0 g peptone, and 15.0 g agar in 1 L H_2O, heat to boiling point, and autoclave 30 min at 121 °C.

e) **Detergent sanitizer solution** – pHisoHex (3% hexachlorophene), or equivalent.

G.2 Apparatus

a) Can opener. – Bacti-Disc Cutter (Wilkens-Anderson Co., 4525 W Division St., Chicago, IL 60651, No. 10810-01), bacteriological can opener (Marmora Machine Co., 1956 N Latrobe Ave., Chicago, IL 60639), or equivalent.
b) Caps. – Disposable, operating room-type (Baxter Hospital Supply Div., 1450 Waukegan Rd., McGaw Park, IL 60085), or equivalent.
c) Pipets. – Straight wall, 200-250 mm long x 7 mm id, 9 mm od (Scientific Products Inc., cut and fire polished, or equivalent).

G.3 Sampling

Conduct test in clean room. (If necessary, open room may be used but outside windows must be closed and direct drafts across work area must be eliminated.) If available, use laminar flow cabinet. Strip labels from cans, examine cans for external defects and record descriptions. Wash cans with soap (or detergent sanitizer solution) and H_2O, and dry with clean paper towels. Wipe counter top with100 ppm Cl solution (e.g., Clorox or diluted

NaOCl solution) immediately before placing washed and dried can on it. Place code end of can in down position and number cans in ink or with $CuSO_4$ marking solution to right of side seam.

Wash hands and face with soap, and rewash hands and face with detergent sanitizer solution. Completely cover hair with clean disposable operating room cap.

Hold non-coded end of can over large Meker burner, just above blue portion of flame. Heat this end of can until all condensation is evaporated; then return can to table in former position. Clean handle and blade of special can opener, (a), with paper towel moistened with 70% alcohol, flame metal portion enough to destroy all microorganisms, and use it to make 4 cm (1.5 in) diameter hole in non-coded, heated end of can. Immediately and without moving can, use straight-wall sterile glass pipet, (c), transfer ca 2 g food to separate tubes, 2 each of aerobic and 2 of anaerobic media (4 total) (No other transferring tool may be substituted). Pre-loosen screw cap and hold it between little and ring fingers while transfer is being made. Flame lips of media tubes both before and after addition of food. When transferring food to anaerobic tubes, food must be inoculated into lower portion of medium. Tighten screw caps after inoculation, incubate tubes 72 hrs at 35°C, and observe daily. Record results for each tube separately.
Remove additional ≥ 10 g food sample from each container with sterile pipet and place in sterile 25 x 200 mm screw-cap test tube. Use pipet-like spatula, if necessary, for this operation (thermophilic contamination unlikely). Number tube to correspond to can and refrigerate for later testing, if necessary.

G.4 Contamination control

Use sterile loop or glass rod to streak plate of glucose starch agar, (c). On table, open plate of glucose starch agar for time equal to longest duration that any medium tube or plate is exposed. Incubate plates at 72 hrs at 35°C, and observe daily.

G.5 Microscopic examination

With pair of metal cutting shears, enlarge hole in can and record odor. Microscopically (oil immersion) examine heat-fixed thin smear of food, stained 10 s with 1% gentian (or crystal) violet and wash in running tap H_2O, or, alternatively, examine wet mounts with phase contrast microscope. If food contains appreciable fat, xylol should be dripped across food smear while it is still hot from heat fixing. Compare stained smear with one made from normal product, if possible.

G.6 pH determination

Determine pH with pH meter, using reference buffer near normal pH of food. Record both reference buffer pH and sample pH. Compare to normal can of food, if available.

G.7 Confirmation of results

If there is any abnormal odor, abnormal appearance, abnormal pH, numbers of bacteria on microscopic examination, and/or growth in media from any can of food, subculture corresponding refrigerated tube as follows: Flame lip of tube and, with straightwall sterile glass pipet, (c), transfer ca 2 g food to 2 tubes each of aerobic and anaerobic media (4

total). Flame lips of media tubes both before and after addition of food. Tighten caps after inoculation, incubate tubes 72 hrs at 55 °C, and observe daily. Record results for each tube separately.

Any organisms isolated from normal cans having obvious vacuum which produce gas in anaerobic medium at 35 °C should immediately be suspected as being from laboratory contamination. Aseptically inoculate growing organism into another normal can, close hole with solder, and incubate 14 days at 35 °C. Any swelling of container indicates that organism was not in original sample. Record as laboratory contamination and review results of additional cans to verify finding of contamination.

Growth in aerobic medium at 35 °C from normal cans indicates either noncommercial sterility or laboratory contamination. Unless there is abnormal odor, abnormal appearance, abnormal pH, and/or numbers of bacteria on microscopic examination from product in original can, record results as laboratory contamination and review results of additional cans to verify finding of contamination. Otherwise, observe subculture results at 55 °C. Growth at 35 °C and absence of growth at 55 °C confirm non-sterility of original container. Check growth under aerobic conditions on nutrient agar plates, (d), at 55 °C and confirm for spores after 72 hrs. Confirmation indicates non-sterility due to flat sour spoilage. Record growth at 55 °C under anaerobic conditions with gas production as commercially sterile. Growth is caused by dormant spores incapable of growth at normal temperatures of storage and distribution.

If only one duplicate tubes is positive after incubation and streaked glucose starch agar is also negative, record as laboratory contamination. Growth on air control plate of glucose starch agar also indicates potential laboratory contamination.

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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Funding Agency

Ms. Grace Estillore Ms. Czarina C. Resurrection	-	Philippine Council for Industrial and Energy Development Department of Science and Technology

Technical Working Group

Academe:

Prof. Teresita P.Acevedo	-	Project Leader University of the Philippines College of Home Economics
Ms. Bernarda G. Dreje		Project Assistant

Government Agencies:

Ms. Teresita S.Palomares Ms. Ma. Dolor L. Villasenor	-	Department of Science and Technology Industrial Technology Development Institute
Ms. Charina May Tandas Ms. Caroline Duller	-	Department of Health Bureau of Food & Drugs
Dr. Gilberto Layese Mr. Mark Matubang	-	Department of Agriculture Bureau of Agriculture Fisheries Product Standards
Ms. Norma Hernandez Ms. Myra F. Magabilin Ms. Rose Marie Castillo Ms. Myrna Almarines	-	Department of Trade & Industry Bureau of Product Standards Food Products Bureau Export Trade & Promotions

Professional/Industry Association:

Dr. Elias E. Escueta	-	Philippine Chamber of Food Manufacturers Incorporated (PCFMI) Philippine Association of Food Technologists (PAFT)