Working Paper Series

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Improving smallholder farmer incomes through strategic market development in mango supply chains in Southern Vietnam

Resource: A2.4 Mango productivity and quality improvements in processed supply chains

Study focus - Processed mango

Code of Practice

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Team: Thi Kim Oanh Tran, SIAEP

Dong Pho Lam, SIAEP

Vinh Phuc Nguyen, SIAEP

Hoai Nam Nguyen, SIAEP

Richard Beyer, Consultant

1 Code of Practice - Scope and objective

This Code applies to the receiving, preparation, processing, handling, storage, transport, distribution, and retailing of frozen mangoes.

The objective of this Code is to provide guidance for the processing and handling of frozen mangoes to help ensure product safety and other aspects of the production of frozen mangoes including, as appropriate, essential quality provisions, composition and labelling provisions of pertinent Codex commodity standards but subject to amendment to incorporate additional specifications mandated by the Vietnamese National Standards TCVN115:2016 (in preparation) and the Caricom Regional Code of Practice (Codex cc.crcp 2010 Latest Modified 2021, Appendix 1). The guidance, emphasising proper cold chain management, incorporates good hygienic and good manufacturing practices and the application of the Hazard Analysis and Critical Control Point (HACCP) approach described in the HACCP Annex to the General Principles of Food Hygiene (CAC/RCP 1-1969). A prerequisite programme is described in the Code, covering essential requirements of hygiene in the production of frozen mangoes that should be in place prior to the application of HACCP.

The food hygiene provisions of this document are supplemental to and must be used in conjunction with the General Principles of Food Hygiene (CAC/RCP 1-1969). The Code should also, as appropriate, be used in conjunction with other Codex texts, including the General Standard for the Labelling of Pre-packaged Foods (CODEX STAN 1-1985), codes of hygienic practice (e.g. Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food (CAC/RCP 47-2001), as well as the Guidelines for the Validation of Food Safety Control Measures (CAC/GL 69-2008). Reference can also be made, as appropriate, to Codex quick frozen food standards and/or provisions in relevant Codex texts.

2 The process

In addition to the provisions of the General Principles of Food Hygiene (CAC/RCP 1-1969) the following additional prerequisite provisions should apply.

Establishment and design of facilities

Location

Processing facilities should, to the extent possible, be located close to the source of raw materials to minimise changes that might lead to quality or safety concerns for raw materials of mangoes prior to freezing.

Process Plant Design

The food processing facility should be designed for the rapid processing, freezing and storage of food products. The processing facility should include a product flow that is designed to minimise process delays and prevent cross-contamination that could affect food quality and safety.

Cold Store Design

The cold store walls, floor, ceiling, and doors should be properly insulated to help maintain appropriate product temperatures. It is important that the design of the cold store ensures that:

- Adequate refrigeration capacity provides and maintains a product temperature of -18°C or colder
- There is adequate air flow around the stored foods
- Storage areas are provided with a capability to control and record temperatures on a regular basis
- Loss of cold air and introduction of warm and humid air are avoided

- Leaks of any refrigerant are prevented. In case of a leak, immediate corrective action ought to be applied to eliminate the problem

Equipment Design and Construction

The equipment should be designed and constructed in such a manner that physical damage to the raw materials and product is minimised, e.g. by ensuring there are no sharp inside corners or projections and that physical, chemical or biological hazards are not introduced into the product. Freezers should be designed and constructed so that, when properly operated, they meet the requirements of a quick-freezing process (CAC/RCP). Facilities In the case of power losses or equipment failure, a contingency plan should be in place to maintain the product temperature.

2.1 Control of operation

Processing before freezing

Mangoes may be processed in many ways before freezing, e.g. cleaning, sorting, cutting, slicing. Whether such processes should be regarded as CCPs depends on the actual conditions, especially on how much time the raw materials and the resulting product spend at temperatures that could result in pathogen growth. It is particularly important that the time spent in the critical temperature zone (i.e. between 10°C and 60°C) be as short as possible.

Recall Procedures

Recall procedures should be in place to ensure timely withdrawal of products that may pose a risk to human health.

Traceability/Product Tracing

The traceability/product tracing system should be designed and implemented according to the Principles for Traceability/Product Tracing as a Tool within a Food Inspection and Certification System (CAC/GL 60- 2006), especially to enable the withdrawal of the product, where necessary.

Establishment Maintenance and Sanitation

Proper maintenance and repair of any damage to the cold store and its infrastructure (e.g. prevention of rust, water leaks, ice accumulation, etc.) should be ensured so that insulation and refrigeration performance is maintained.

Training

Staff should have the skills and knowledge appropriate to their work to ensure that safety and quality of foods is not adversely affected during handling. Staff should also be aware of the importance of maintaining temperature control for frozen foods to maintain the quality and safety of the foods. Training programs should be in place (either formal training courses or training provided whilst working) to ensure that staff have these skills and knowledge.

Clean-down

Clean-down procedures are to be formalised, implanted, and documented with provision for cross-checking at supervisory or management level. Procedures should include protocols for premises and staff. They should mandate cleansing chemicals including cross checking of dilution, residence time and temperature where appropriate.

3 Raw materials

Raw materials used should be safe, sound, and suitable for further processing. Procedures should be in place to ensure quality and safety of incoming materials. Freezing cannot improve quality, and it is necessary to use raw materials of optimum quality. Many raw materials and food products are highly perishable and should be handled carefully to maintain their quality until the freezing process is initiated. Initial microbial levels in raw materials to be frozen should be kept as low as possible, both for food safety and quality reasons.

Minimum requirements

Depending on the specific requirements for each class and tolerance, all fresh mangoes must be:

- Whole
- Wound, mangoes affected by rotting or deterioration such as to make it unfit for consumption is excluded
- Clean, practically free of any visible foreign matter
- Practically free of damage caused by pests
- Free of abnormal external moisture, excluding condensation following removal from cold storage
- Free of any foreign smell and/or taste
- Firm
- Fresh in appearance
- Free of damage caused by low temperatures
- Free of black necrotic stains or trails
- Free of marked bruising
- Sufficiently developed and display satisfactory ripeness

When a peduncle is present, it shall be no longer than 1.0 cm.

The development and condition of the mangoes must be such as to enable them:

- To ensure a continuation of the maturation process until they reach the appropriate degree of maturity corresponding to the varietal characteristics
- To withstand transport and handling
- To arrive in satisfactory condition at the place of destination

In relation to the evolution of maturing, the colour may vary according to variety.

Classification

Mangoes are classified in three classes defined below:

Special Class

Mangoes in this class must be of superior quality. They must be characteristic of the variety. They must be free of defects, except for very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

Class I

Mangoes in this class must be of good quality. They must be characteristic of the variety. The following slight defects, however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- slight defects in shape
- slight skin defects due to rubbing or sunburn, suberised stains due to resin exudation (elongated trails included) and healed bruises not exceeding 3, 4, 5 cm^2 for size groups A, B, C respectively

Class II

This class includes mangoes which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified in Section 2.1 above. The following defects, however, may be allowed, provided the mangoes retain their essential characteristics as regards the quality, the keeping quality and presentation:

- Defects in shape
- Skin defects due to rubbing or sunburn, suberised stains due to resin exudation (elongated trails included) and healed bruises not exceeding 5, 6, 7 cm² for size groups A, B, C respectively

In Classes I and II, scattered suberised rusty lenticels, as well as yellowing of green varieties due to exposure to direct sunlight, not exceeding 40% of the surface and not showing any signs of necrosis are allowed.

Size requirements

Size is determined by the weight of the fruit (examples below):

Size Code	Weight (grams)
A	200 – 350
B	351 – 550
C	551 – 800

The maximum permissible difference between fruit in the same package belonging to one of the above-mentioned size groups shall be 75, 100 and 125 g respectively. The minimum weight of mangoes must not be less than 200 g.

Raw materials for processing and quick freezing should be prepared without delay and appropriate temperature control should be applied in order to minimise possible microbiological, chemical or biochemical changes that might affect safety and quality. To minimise deterioration, raw materials should be cooled and stored under appropriate conditions (e.g. pre-cooling) or transported and frozen in the shortest time possible.

4 Quick-freezing process

The quick-freezing process should be performed in such a manner as to minimise physical, biochemical, and microbiological changes, by taking into account the freezing system or process and its capacity and volume of production.

This is best achieved by ensuring that the product passes quickly through the temperature range of maximum ice crystallisation – commonly -0.5ºC to -5.5ºC.

The quick-freezing process step may be considered an essential quality provision. During freezing operation it is important to provide spaces or channels permitting air circulation between the cartons or alternative intermediate containers.

Freezing may be a CCP See HACCP Annex to the General Principles of Food Hygiene (CAC/RCP 1-1969). The quick-freezing process should not be regarded as complete until and unless the product temperature has reached -18°C or colder at the thermal centre, after the stabilisation of the temperature.

On exit from the freezing apparatus, the product should be moved to a cold store as quickly as possible to minimise exposure to warm temperatures and high humidity and to maintain the product temperature at -18°C or colder.

Product specification can be prepared in conjunction with market requirements (see Appendix 1).

5 Packaging and labelling

Packaging

In general, the packaging should:

- Protect the food against dehydration
- Protect the food against microbial and other contamination that could adversely affect safety and quality
- Protect the sensory and other quality characteristics of the food
- Not add to the food any substance that may influence the safety and quality of the food. The packaging or re-packing of quick-frozen mangoes should be carried out in such a manner that an increase in temperature, within the permitted tolerances of the quick-frozen foods, does not adversely affect the safety and quality of the product

Labelling

The labelling of packaged quick-frozen foods should comply with the requirements of the General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985) and the relevant Codex standards for quick frozen foods. See Guidelines for the Validation of Food Safety Control Measures.

6 Appendices

Appendix 1: Caricom Regional Code of Practice

CARICOM REGIONAL CODE OF PRACTICE

CODEX cc.crcp 2010 Last Modified 2021

Preparation of frozen fruit pulp and purées

General requirements

4.1 Fruit

4.1.1 The fruit used shall be sound, wholesome, ripe or appropriately mature, clean and safe.

4.1.2 Physical hazards such as animal or plant debris and other foreign material shall be removed by manual sorting and cleaning. NOTE 1 Metal detectors may be used to assist in the removal of metal. NOTE 2 Inspection of fruit may be considered a critical control point (CCP).

4.1.3 Fruit shall have a firm texture and its characteristic flavour.

4.1.4 Fruit shall be sorted to separate green and over-ripe ones. Fruits which have been damaged shall be washed, drained and stemmed with extra care. Such damaged fruits shall be cut, peeled and pits removed, if necessary. EXAMPLE Damage includes bird-pecks and bruises NOTE This process may be considered a CCP.

4.1.5 Fruit shall not be allowed to soak in wash water. NOTE This is to prevent possible loss of nutrients and flavour, and entrance of microbes.

4.1.6 Unsound, unripe, inferior or damaged fruits and vegetables shall be removed and kept separate from those selected for processing. They shall be placed in an identified, appropriate waste disposal container.

4.2 Equipment

4.2.1 Food press or strainer shall be used to make purées. Blenders and food processors may also be used to liquefy the fruit. NOTE Maintenance or sanitation of the processing equipment may be a CCP.

4.2.2 Galvanized equipment shall not be used in direct contact with fruit. NOTE Acid in the fruit may dissolve zinc from galvanized equipment which causes the product to become harmful.

4.2.3 Utensils used shall be made of stainless steel.

4.2.4 Iron utensils, copper or chipped enamelware shall not be used. NOTE Metallic off-flavours can occur as a result of their use.

4.3 Packing

4.3.1 There shall be head space between the packed pulp or purée and the closure to allow for expansion during freezing.

4.3.2 The sealing edges of freezing containers shall be free of moisture and food particles before sealing or closing the freezer containers. The packaging shall be labelled as stated in 12.

5 Quality criteria

5.1 Flavour and odour

5.1.1 Finished fruit pulp or purée product shall have a flavour and odour typical of the type of fruit from which it was derived.

5.1.2 Finished fruit pulp or purée shall have no foreign odours or flavours, such as stale, yeasty, burnt, musty, rancid or mouldy.

5.2 Colour

Finished fruit pulp or purée shall have a bright colour, free from oxidation that is typical of the fruit from which it was derived.

5.3 Consistency

5.3.1 Finished fruit pulp may consist of lumps and fibres.

5.3.2 Finished fruit purée shall be a homogeneous product that is pliable, and any lumps present should be easily broken under gentle pressure. Lumps in the finished fruit purées shall not exceed 6.35 mm in diameter.

5.3.3 Finished fruit purées shall be easily spreadable. The single strength purée shall be fairly thick and reasonably smooth with a slight amount of free liquid at the edge of the mass.

5.4 Age requirement

Pulps or fruit purées shall be manufactured from the freshest fruit of the current crop.

5.5 Additives or preservatives

The use of additives in fruit purées shall be as specified in 7. Water may be added if required to standardize Brix levels to meet the specification level.

5.6 Shelf life

The minimum shelf life for the finished fruit pulps and purées shall be between 9 and 12 months.

5.7 Defects

5.7.1 Each type of fruit purée shall be free from pit fragments and shall be practically free from, but not limited to, stems and black, brown, green or other discoloured tissue that are uncharacteristic, and that are readily visible in a 454 g sample.

5.7.2 Each type of fruit purée shall not include more than one piece of stem or black, brown, green or other discoloured tissue that is over 4.75 mm in any dimension.

5.8 Foreign material

Fruit purées shall be clean, sound, wholesome, and free from evidence of foreign material such as dirt, silt, sand, thorns, insect parts, hair.

Appendix 2: Product Specification

PRODUCT SPECIFICATION

Frozen mango half cut

Product type: Frozen mango half cut

Latin name: *mangifera*

Varieties: Cat Chu mango

Count size (fresh material): 230gr-up

Product weight (Pc/gr): 4-5Pcs/500gram

Harvest area: Cao Lanh, Dong Thap province, Viet Nam

Product country of Origin: Viet Nam

Description: Frozen mango fresh cut are made from natural mango conforming with the standard procedures and strict hygienic conditions.

Parameter group	Range value
1. Physico-chemical and Organoleptic	
Foreign material (grass, hair, animal hair, plastic, wood):	absent
Pool shape	≤ 1 piece per kg
Woody/fibrous	< 1 piece per kg
Pieces with skin	≤ 1 piece per kg
Brownish spot > 3mm	≤ 1 piece per kg
Ice	< 3%
Brix (%)	12-up
Brix < 12%	≤ 1 piece per kg
Acidity	0.3-0.6
Odour	Characteristic of cat Chu mango
Colour	Light yellow to yellow
Tar colour	Absent
Texture	Soft

2. Microbiological	Unit of Measure	Target
Salmonella	/25gr	Not detected
E.coli	/25gr	Not detected
TPC	CFU/g	< 10^5
Coliform	CFU/g	< 100

3. **Additives and preservatives:**
   Authentic product, free from added sugar, preservatives and pigments
   Product is free from known allergen, genetically modified organism
4. **Additional test:**
   Pesticide residue and heavy metal: one time/year
   Additional, specific tests can be carried out on request
   Product is Halla certified and suitable for vegans, vegetarians

5. **Quality standard:**
   HACCP, GMP, SSOP systems are applied in the manufacturing, storage and other operation. Product is approved for HALLA. The system is certified for BRC
6. **Packing:**
   IQF, 500gram/Prin bag vacuum x 20/container or as buyer's request
7. **Shelf-life and storage**
   Minimum life on delivering: 20 months from loading date
   Maximum life from manufacture: 24 months from production date
   Temperature: keep frozen at or below -18^{0}C
8. **Labelling:**
   Every box labelled with product name, traceability data (batch No. Box sr. No.), date of manufacturing, best before, net weight, country of origin.