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MANGO PROCESSING

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'Our Business is Industry…"

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MANGO PROCESSING

INTRODUCTION

Several assorted fruits abound in the Philippines throughout the whole year. Each season produces a variety of fruits. However, there are some fruits, e.g., mango, which can now be harvested almost anytime of the year in some areas. Abundant supply floods the market during the summer months.

The Philippine mango comes in many varieties. The carabao mango, better known as Manila Super Mango, is one of the world's best varieties. It makes the country competitive in the world market. The major importers of mango are Japan, Singapore and Hongkong. Other popular varieties are Pico and Katchamita (Indian Mango).

DRIED MANGO

PRODUCT DESCRIPTION

Dried mango is obtained from rareripe carabao mangoes dried through the principle of osmosis followed by drying with the use of cabinet drier. The finished product is golden yellow with a semi-translucent, plump appearance, chewable texture which is neither crisp nor leathery and a flavor characteristic of sweetened mango.

Ingredients

rareripe (carabao var.) mango
refined sugar
confectioner's sugar
sodium metabisulfite (or combination of sodium erythorbate and citric acid), food grade

Equipment/Utensils

stainless-steel knife
mechanical drier
wire trays lined with *sinamay* or cheesecloth
stove and LPG

Packaging Material

OPP or PE plastic bags of 0.003 mm thickness

Procedure

1. Wash mangoes to remove surface dirt.
2. Peel mangoes using stainless steel peeler; slice along its lateral axis from both sides of the middle seed section, and cut the cheeks into pieces with a thickness of approximately 1.5 cm.

3. Add white sugar (50% by weight) to mango slices. The sugar is allowed to melt in the mangoes. (Another method of syruping is by quick process in which a mixture of 50 parts sugar and 50 parts water is heated and added to the mango slices.)
4. Heat the mangoes until the slices become translucent. Cool.
5. Add 0.1% of sodium metabisulfite (1 g for every kilogram of mango slices). Mix thoroughly.
6. Soak mangoes in syrup for at least 18-20 hours. Drain. Rinse slices with running water.
7. Lay mango slices on trays lined with cheesecloth. Dry in a cabinet drier at 60°-65°C for 10-14 hours. Drying may be done in a solar drier as long as drying area is clean and free from dust, rodents and other insects.
8. Remove from trays and loosely pack dried mangoes in ordinary plastic bags. Allow mangoes to sweat at ambient condition for 18-24 hours.
9. Roll in confectioner's sugar. Remove excess coating through straining or brushing.
10. Pack and seal in OPP or PE plastic bags.
11. Store in a cool, dry place.

FROZEN MANGO

Ingredients

rareripe to ripe mangoes (carabao or *piko* variety)
refined white sugar
ascorbic or citric acid or kalamansi juice

Utensils

stainless steel knives
bowls

Packaging Material

polyethylene bags

Procedure

1. Weigh, sort rareripe or ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Slice mango into halves. Scoop out edible flesh.
6. Mix gently with sugar (5:1) containing 0.1% ascorbic or citric acid* or kalamansi juice (1 tsp kalamansi juice for every 2 cups of sugar).
7. Pack in polyethylene bags. Seal.
8. Freeze immediately (0° to –25°C).

**please see Annex A*

MANGO MARMALADE

Ingredients

ripe mangoes (carabao or *piko* variety)
refined white sugar
citric acid
lemon rind

Utensils

Waring blender or a coarse sieve
stainless steel knives
stainless steel/plastic mixing bowls
measuring cups
wooden spoon

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load. Drain.
4. Slice mango into halves. Scoop out edible flesh.
5. Pass through Waring blender or coarse sieve. Set aside.
6. Steam blanch lemon rind in a steamer for 5 minutes. Air cool.
7. Mix the pulp with an equivalent amount of sugar (1:1) by weight.
8. Heat over low fire, stirring constantly. Add sliced lemon rind. When almost thick, add 0.3% citric acid* based on the weight of the pulp used.
9. Continue heating until temperature is 105°C (221°F) or until the mixture can be spooned out.
10. Fill into sterilized jars. Seal tightly.
11. Air cool. Label and store.

**please see Annex A*

MANGO CHUTNEY

Ingredients

4	cups	sliced green mangoes (carabao or *piko* variety)
½	pc	large ginger root
1	clove	garlic
8	pcs	native onions
2	pcs	hot pepper
1	small box	raisins
2	cups	vinegar
3	cups	white sugar
4	tbsp	coarse salt

Utensils

stainless steel knife	measuring cup
paring knife	saucepan
cutting or chopping board	wooden spoon

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort green mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Peel mangoes, remove seeds, and slice into longitudinal pieces of ¼-inch thick.
6. Add salt to the sliced green mangoes. Soak overnight.
7. Drain the salted mangoes.
8. Boil vinegar and sugar. Add spices. Simmer for 5 minutes.
9. Add sliced mangoes and cook until thick.
10. Pack in sterilized jars. Seal.
11. Air cool. Label and store.

MANGO HALVES IN SYRUP

Ingredients

firm rareripe or ripe mangoes (carabao or *piko* variety)
refined white sugar
calcium chloride ($CaCl_2$), optional

Utensils

sharp stainless steel knives
stainless steel/plastic mixing bowls
stainless steel basting spoon
steamer

Packaging Material

2T cans or sterilized glass jars with PVC caps

Procedure

1. Select firm rareripe or ripe mangoes that are free from bruises and other blemishes.
2. Weigh, sort mangoes.
3. Wash in clean tap water to remove surface dirt.
4. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
5. Drain.
6. Slice mango into halves. Scoop out edible flesh and place directly into cans.
7. Prepare medium syrup (35°Bx, approximately 1 cup sugar for every 2 cups of water). If desired, use 50°Bx syrup (1 cup sugar for every cup of water).
8. Pour hot syrup into cans or glass jars. Observe proper headspace.
9. Exhaust (remove air) by heating the filled cans or bottles over a steamer until the internal temperature of the glass or can reaches 82°C).
10. Seal cans or cap jars tightly.
11. Process in water at boiling temperature (100°C or 212°F) for 25 minutes.
12. Cool cans in running water. Air cool glass jars.
13. Label and store.

Note: *$CaCl_2$ may be added to improve texture as long as it does not exceed 0.07% based on the weight of the syrup.*

MANGO JAM

Ingredients

ripe mangoes (carabao or *piko* variety)
refined white sugar
citric acid

Utensils

Waring blender or a coarse sieve
stainless steel knives
stainless steel/plastic mixing bowls
measuring cups
wooden spoon

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Slice mango into halves. Scoop out edible flesh.
6. Pass through Waring blender or coarse sieve.
7. Mix the pulp with an equivalent amount of sugar (by weight).
8. Heat over low fire, stirring constantly. When almost thick, add 0.3% citric acid* based on the weight of the pulp used.
9. Continue heating until temperature is 105°C (221°F) or until the mixture can be spooned out.
10. Fill into sterilized jars. Seal tightly.
11. Air cool. Label and store.

**please see Annex A*

MANGO JUICE

Ingredients

2½	cups	comminuted ripe mangoes (carabao or *piko* variety)
½	cup	refined white sugar
¼	tsp	citric acid (food grade)

Utensils

Waring blender or a coarse sieve
stainless steel knives
stainless steel/plastic mixing bowls
measuring cups
stainless steel basting spoon

Packaging Material

2T cans or sterilized glass jars with PVC caps

Procedure

1. Weigh, sort ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Slice mango into halves. Scoop out edible flesh. Separate flesh from the seed using blunt edge of knife being careful not to include the fibers.
6. Comminute the flesh using a Waring blender or coarse sieve to obtain smooth puree.
7. Add sugar equivalent to 1/5 its volume. Adjust flavor by adding citric acid.
8. Pasteurize until the internal temperature of the mixture reaches 82°C (180°F).
9. Fill into cans or sterilized jars leaving ¼-inch or 1/3-inch headspace.
10. Seal immediately and process in water bath at 100°C (212°F) for 10 minutes.

11. Cool cans in running water. Air cool glass jars.
12. Label and store.

SWEET SOUR MANGO

Ingredients

fresh mature green mangoes (carabao or *piko* variety)
refined sugar
salt

Utensils

stainless steel knife
pickling jar
bowls

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort green mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Peel mangoes, remove seeds, and slice into longitudinal pieces of ¼-inch thick. (If desired, the fruits may be used unpeeled).
6. Add salt equivalent to 10% of the weight of the mango slices.
7. Store overnight in a refrigerator.
8. Drain, wash and squeeze out excess juice.
9. Soak in thick syrup (50°Bx – approximately 1 cup water to 1 cup sugar) for at least two days.

10. Store in refrigerator until ready to serve.

Note: For longer storage under refrigerated conditions, the following modifications of the procedure are necessary:

11. Follow steps 1-9 as indicated above.
12. Drain mango slices from the syrup. Boil the syrup.
13. Rinse drained mango slices in hot water.
14. Pack in glass jars and pour hot thick syrup containing 0.1% sodium benzoate based on the weight of the syrup (approximately ¼ tsp sodium benzoate for every 4 cups of syrup). Leave 1/3-inch headspace.
15. Seal. Invert glass jars for 2 minutes and allow to cool at room temperature.
16. Label and store in refrigerator.

PICKLED MANGO

Ingredients

fresh immature green mangoes (carabao or *piko* var.)
10% brine (approximately 1½ tbsp coarse salt for every cup of water; boil and cool)

Utensils

stainless steel knife
stainless steel/plastic mixing bowls
chopping board
pickling jar
stove

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort green mangoes.
2. Wash in clean tap water to remove surface dirt.

3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Peel mangoes, remove seeds, and slice into longitudinal pieces of ¼ inch thick. (If desired, the fruits may be used unpeeled).
6. Place in pickling jars. Add 10% brine solution*.
7. Let stand for at least a week until the mixture has a pleasant fermented odor. Stir the mixture daily.
8. Remove mango slices from the brine. Rinse mango slices with boiling hot water. Pack in jars.
9. Boil the brine and remove the scum if there is any.
10. Fill the jars containing mango slices with boiled brine. Leave 1/3 inch headspace. Seal and allow to cool at room temperature. Label and store.

**please see Annex A*

MANGO-TOMATO JAM

Ingredients

ripe mangoes
ripe tomatoes
refined sugar

Utensils

stainless knife
stainless peeler
stainless colander
stainless mixing bowls
stainless kettle
stainless/wooden ladle
stove

Packaging Material

sterilized glass jars with PVC caps

Procedure

1. Weigh, sort rareripe or ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Blanch the tomatoes, remove the seeds and chop finely.
6. Combine the mashed tomato and mango.
7. Add 1½ cups sugar for every 2 cups of the mashed mixture.
8. Cook the mixture until thick and transfer while hot to sterilized jars and seal tightly.
9. Process on water bath for 20 minutes.
10. Air cool, label and store.

MANGO PUREE

Product Description

Mango puree is the extract obtained from mango pulp and does not contain added water, sugar or any other ingredient. This means that 100% of it is mango.

Ingredients

ripe mangoes (carabao var.)

Utensils

stainless steel knife	double boiler
stainless steel/plastic mixing bowls	casserole
stainless steel scooping spoon	stove
blender	thermometer

Packaging Material

8-oz sterilized glass jars with new PVC caps

Procedure

1. Weigh, sort rareripe or ripe mangoes.
2. Wash in clean tap water to remove surface dirt.
3. Soak in 200 ppm chlorinated water for 10 minutes to reduce microbial load.
4. Drain.
5. Slice along its lateral axis from both sides of the middle seed section, scoop out mango flesh and peel seeds.
6. Grind mango flesh thru blender.
7. Pasteurize the pureed mango at 80°C for 10 minutes using double boiler.
8. Fill puree (while hot) in sterilized glass bottles and seal.
9. Process or sterilize filled containers in boiling water (100°C or 212°F) for 20 minutes.
10. Air cool and store in dry cool place.

MANGO LEATHER

Product Description

Mango leather, sometimes called mango roll or mango toffee, is prepared from the puree of table-ripe mangoes, dried to form glossy sheets and cut into desired sizes. The product is about 1 mm thick, deep orange in color with the characteristic mango flavor. The product is leathery but chewable. Its texture can be described as somewhat pliable but can still be torn into pieces.

Mango leather can be eaten as is, as a snack or dessert, or used as pie fillings and toppings for cakes. The product remains of good eating quality for years when stored in the freezer, for several months under refrigeration, and for about 7 months at ambient conditions.

Ingredients

ripe mangoes (carabao var.)
pure refined white sugar (optional)

Utensils

stainless steel knife
stainless steel/plastic mixing bowls
stainless steel basting spoon
blender
double boiler
casserole
stove
thermometer
refractometer

Packaging Material

OPP/Met foil/PE plastic bags
PE bags (0.003mm thickness)

Procedure

1. Select mature table ripe mangoes, preferably the carabao variety.
2. Sort out and grade to ensure uniformity of size.
3. Weigh.
4. Wash in clean tap water to remove surface dirt.
5. Soak in 150 to 200 ppm chlorinated water for 10 minutes to reduce microbial load.
6. Drain. Slice mango along its lateral axis from both sides of the middle seed section. Scoop out mango flesh. Peel seeds. Scrape the edible pulp avoiding the fiber portion.
7. Blend thoroughly to obtain a homogenous mixture.
8. Check TSS using a refractometer. Adjust the soluble solids content of the puree to 20°Brix* using pure refined white sugar.
9. Pasteurize the mango puree (80° to 82°C for 15 minutes) using double boiler.
10. Spread puree evenly on stainless steel trays.

**please see Annex A*

11. Dry in a cabinet dryer at 60 ± 5°C for 10-14 hours. Drying may be done in a solar dryer as long as drying area is clean and free from dust and flies, rodents and other insects.
12. Remove from trays and loosely pack mango leather in ordinary plastic bags. Allow mango to sweat at ambient condition for 18-20 hours.
13. Coat mango leather with confectioner's sugar to remove filmy and shiny appearance.
14. Cut into desired sizes and shapes.
15. Pack in appropriate packaging materials. Seal.
16. Pack in carton boxes. Label and store in a cool, dry place.

ANNEX A

HOW TO PREPARE

I. *Calcium Hypochlorite Stock Solution (CHLORINATED WATER)*

A. Concentration of desired solution: 10,000 ppm stock solution = C_2
Volume of desired solution: 1 gallon (3.78 liters) = V_2
Percentage available chlorine in hypochlorite granules: 70% = C_1

Calculation:

$$\mathbf{C_1 V_1 = C_2 V_2}$$

where:

V_1 = volume of desired concentration
V_2 = required amount needed for final concentration
C_1 = percentage available in solution/granules
C_2 = concentration of desired solution

$$C_1 = \frac{C_2 V_2}{V_1}$$

$$V_1 = \frac{C_2 V_2}{C_1}$$

$$C_2 = \frac{C_1 V_1}{V_2}$$

$$V_2 = \frac{C_1 V_1}{C_2}$$

Problem:
Prepare one gallon stock solution with 10,000 ppm concentration using calcium hypochlorite (CaOCl) granules with 70% available chlorine.

Required:
Amount of calcium hypochlorite granules needed to prepare 10,000 ppm concentration of stock solution.

Solution:
Volume of stock solution = 1 gal (3.78L; density_{water} = 1 kg/L; therefore 3.78 kg)

Weight of stock solution = 3.78 kg

$$\mathbf{C_1 = \frac{C_2 V_2}{V_1}}$$

$$C_1 = \frac{(3.78\ kg)\ (1\%)}{70\%} = \mathbf{0.054\ kg\ or\ 54\ g}$$

Preparation:

Dissolve 54 g calcium hypochlorite granules in 1 gallon water. Mix.

B. Prepare a gallon chlorinated water with concentration of 30 ppm needed to sanitize food handlers hand. How much stock solution with concentration of 10,000 ppm is required to make the desired chlorinated water for sanitizing food handler's hand?

Given:

Let V_2 = Volume of desired chlorinated water = 3.78 L

C_2 = Concentration of desired chlorinated water = 30 ppm

C_1 = Concentration of stock solution = 10,000 ppm

Required:

V_1 = Volume of stock solution needed to prepare a gallon of chlorinated water with concentration of 30 ppm

Solution:

$$\mathbf{V_1 C_1 = V_2 C_2}$$

$$\mathbf{V_1} = \frac{V_2 C_2}{C_1} = \frac{(3.78\ L)\ (30\ ppm)}{10{,}000\ ppm}$$

$$\mathbf{V_1 = 0.01134\ L\ or\ 11.34\ mL}$$

Preparation:

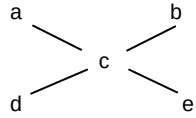
Add 11.34 mL of stock solution from A to 1 gallon water. Mix.

To 11.34 mL of stock solution from A, add enough water to make 1 gallon. Mix thoroughly.

C. Prepare a gallon of chlorinated water with concentration of 200 ppm.

COMPUTATION - SAME AS B.

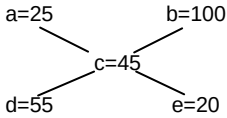
II. *Amount of sugar using the Pearson's Square Method*



where:

a	:	initial soluble reading
b	:	purity of sugar
c	:	desired soluble solid concentration
d	:	difference between purity and desired
e	:	difference between desired and initial
f	:	quotient between e and d

Calculate the amount of sugar required to adjust the 3 kg of mango puree with an initial concentration of 25°Bx to a final concentration of 45°Bx.



a	:	initial = 25°bx
b	:	purity of sugar = 100%
c	:	desired = 45°bx
d	:	difference between b & c = 100 – 45 = 55
e	:	difference between c & a = 45 – 25 = 20

To compute:

$$\mathbf{f} = \frac{e}{d} = \frac{20}{55} = 0.364$$

Requirement: **Amount of sugar needed to adjust 3 kg mango puree to 45°Bx.**

0.364 x 3 kilos = 10.91 grams or 1.091 kg sugar

You will need to add 1.091 kg or 10.90.91 grams sugar to 3 kg of mango puree to have a final concentration of 45°Bx.

III. ***0.1% ascorbic acid***

0.1% convert to 0.001 = 0.001 x 1 kilo = 0.001 kg or 1 gram for every kilo

IV. ***0.3% citric acid***

0.3% convert to 0.003 = 0.003 x 1 kilo = 0.003 kg or 3 grams for every kilo

V. ***10% brine solution***

1 part salt to 9 parts water