REPORT ON THE CONSULTANCY WORK ON PRODUCT DEVELOPMENT AT ROBERT REIMERS ENTERPRISE, MAJURO, MARSHALL.

4-27 February, 2009

Report Part 1

Project funded by the Secretariat of the Pacific Community, Nabua Suva Fiji

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University of the South Pacific
2009
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Report on Work carried out at Robert Reimers Enterprises (RRE), Republic of the Marshall Islands

February 4 – 27, 2009

Executive Summary:

The consultancy work carried out at Robert Reimers Enterprise from the 4–27 February, 2009 was divided into two parts. Firstly the Product Development work on the Pandanus fruits and the training of local counterparts and workers in processing and development of products which included process management and hygienic practices. This also involved active participation in the Pandanus Festival on 7 February where products produced were tested through a consumer tasting survey through a wider range of consumers. The consumer survey showed a larger percentage of consumers, 90%, preferring the pandanus nectar and the 35% pandanus juice concentration produced and showed very low acceptability for concentrated Pandanus juice which is currently produced at the plant. The team at the Pacific Business centre in Hawaii also endorsed the 35% Pandanus juice concentration as a hit product and also found the current juice mix as unacceptable. Other products that attracted the consumers were the pandanus syrup, pandanus baby food and pandanus jam which gained popularity at the Tide Table restaurant.

The second part of the consultancy work involved the development of the business or marketing plan which involved the marketing survey at Majuro as well as Hawaii in discussion with the Pacific Business Centre of the University of Hawaii and working with the management team of RRE. This is a separate report.

There is great potential for the Pandanus juice to be produced commercially in the Marshall, because of its nutritious composition and attractive colour and taste. Work is underway to identify the particular variety that produces more pulp, more yield and provides better taste and farmers have been encouraged to grow such varieties.

1.0 Introduction:

This is a report on the work carried out on the product development of pandanus fruit processing for Robert Reimers Enterprises (RRE) in preparation for the first ever to be held Pandanus Festival in the Marshalls (on 14 February, 2009). The project also looks at the potential of commercializing this process on a larger scale. This involves improving current processing methods, developing potential market products and training of process workers on product development and hygienic practices of pandanus processing to meet quality standard. The work task also includes the development of a business or marketing plan for Pandanus processing.

The objective of the visit by the consultant, Ms Apiamen Cegumalua of the Institute of Applied Science (IAS), University of the South Pacific (USP), is to assist RRE with pandanus processing and developed
products that could be marketed locally and overseas. The project was sponsored by the Secretariat of the Pacific Community (SPC), Fiji.

Pandanus processing is in its infancy stage, the current practice is basic, which involves the raw extraction of juice through a heavy duty pulper/extractor custom designed from Taiwan, for this purpose and the juice is then subjected to a centrifuge to remove solids before bottling at a high concentration pulp 86% and 14% water ratio. There is no heat treatment along the line and the packed bottled juice is kept frozen which resulted in a one day to less than a day shelf life out of the freezer depending on the outside temperatures.

Currently the pandanus processing work is of least priority to the company that has other major money making enterprises to focus on, so pandanus processing at RRE is fairly dependent on the amount of pandanus bunches that is received in a day which can be as high as 100kg of fruit, (which tales about half a day processing,) so the plant is not fully maximized in its capacity. There was no weighing to determine yield, no costing carried out to ascertain the cost of production, however the price of the 340ml PET bottled juice of about 86% fruit juice is determined by what the consumers can afford, at USD2.00/bottle.

The process workers that run the pandanus plant are part of the team that work at the Pacific Pure Water (PPW) plant (another of RRE’s business enterprise) which is of higher priority because of market demand and the high income it brings in compared to the Pandanus. So least of the priority of time and effort is currently placed on pandanus processing. Hopefully after the consultant’s visit, this will be changed as products developed with costs determined, market price set and with the business and marketing plan outlined, the pandanus processing plant will definitely established itself as a money making venture for RRE.

2.0 Background:

RRE is a successful enterprise, a well established company and has been in business for over 50 years. From the beginning RRE has been a family owned and operated Marshallese business enterprise. RRE is a conglomerate of companies involved in many different businesses including: hotel, restaurant and lounge and eco tourism. It is an agent for cruise liners, shipping lines and Fishing vessels and also for Western Union Money Transfer. It owns and operates Pacific Pure Water, Inc. which is the major producer of fresh water in the Marshall Islands. It operates Napa Auto Repairs, Mobil Gas stations, Commercial and Residential Real Estate and Managers the Marshall Broadcasting Company. It is experienced in mechanical repairs and boat repairs.

RRE is committed to the growth of Marshall economy and community development and employs more than 100 Marshallese in all its enterprises.

RRE is well known throughout Micronesia and the Pacific due to its integrity and commitment to service and to the people on the Marshall Islands.
One of its newest enterprises is Bobo juice or pandanus juice which is in its development stage. Mr Ramsey Reimers, the Managing Director of RRE has realized the potential of this nutritious indigenous fruit and is adamant to promote its consumption in the local market for the locals as well as for all visiting tourists in the islands, for his guests at the hotel and the restaurant.

3.0 The Product Development Project:

The consultancy project outlined that the consultant trains Pandanus plant workers in Processing, hygiene practices and quality as well as product development. The consultant was also tasked to develop the business and marketing plan. (Refer to contract attached (Appendix 1) for the required work to be carried out at RRE).

3.1 Pandanus: is a traditional crop to the Marshall, second to coconut and breadfruit, a staple crop which is rich in carotenoid, a vital source of Vitamin A. Pandanus fruit has been part of the Marshallese diet for many years and there are many traditional methods of preparation and preservation and very little is documented.

The project with RRE is to develop potential pandanus products that can be of commercial values with longer storage life and can be marketed locally and overseas. The current practice at the plant is pulping and extraction of juice after trimming followed by screening through the use of a centrifuge and then bottling before freezing at -15 degree C.

The frozen product is sold in the RRE Tide Table restaurants and shops and storage life is limited to one day while out of the freezer. In this Secretariat of the Pacific Community (SPC) sponsored project, it is anticipated that a longer storage life juice is produced as well as other potential pandanus products for future processing production and sales.

There has been on-going plans for the first ever pandanus festival to be held on the 14th February 2009 and the festival is being organised to display the many products that can be made out of the fruits, to highlight its valuable nutritional values for young and old alike at the same time to explore the many benefits of the pandanus tree itself.

3.2 Factory Operation and Pandanus Processing at RRE

The factory site is part of the office building, adjacent to the shipping services and property manager department. It has a large room space measuring about 9 x 6m and two small rooms, one which houses the freezer and sometimes a storage space for the Pandanus and the other for dry goods. There are two exit doors, one to the outside and the other to the main office area. The plant consists of a:
- Reimers custom made pulper extractor machine, - a centrifuge, a double cooker, a F-868 cup closing machine, a cutting table, twin tub stainless steel tubs, two cutting knives, two tables, one for packing bottle juice and the other for desk top work.

The processing of pandanus started in 2007 and has been going on at a very small scale to promote the healthy drink to guests and tourists at Tide Table Restaurant, a company owned entity.

Refer to table 1 for the processing method carried out. The juice bottled has a limited shelf life and must be consumed immediately after removal from freezer and thawed.

The italics and bolded letters are suggested and recommended practices to be followed.

**Table 1: Processing of Pandanus**

<table>
<thead>
<tr>
<th>Steps</th>
<th>Current processing practice</th>
<th>Recommended practices</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Receive pandanus from suppliers</td>
<td>Receive pandanus from suppliers, reject unripe and damaged fruits</td>
<td>It's important to give the suppliers the right specification, as well as the right information and make sure they follow i.e. when to bring in supplies and stage of ripeness and variety required.</td>
</tr>
<tr>
<td>2</td>
<td>Select ripe ones and remove keys (pandanus fruits)</td>
<td>Select ripe bunches, weigh and record wt. Take note of the different varieties and record</td>
<td>It is important that variety and weight of pandanus is known.</td>
</tr>
<tr>
<td>3</td>
<td>Wash in the tub and drain</td>
<td>Remove keys (pandanus fruits and wash thoroughly) and drain</td>
<td>Portable water is used at all times and pandanus must be washed thoroughly</td>
</tr>
<tr>
<td>4</td>
<td>Cut the yellow ripe portion</td>
<td>Ensure that the knives are clean and the table top for cutting is clean. Cut the yellow ripe portion</td>
<td>It is important that all workers are clean, wearing clean clothes, have clean hands, nails, and practice good clean habits during processing. Knives and table tops must be cleaned</td>
</tr>
<tr>
<td>5</td>
<td>Collect ripe pieces in a clean bin</td>
<td>Collect ripe pieces in a clean bin and weigh</td>
<td>The bin must clean and not to be used for other purposes outside the factory. Recording weight at every step is important to be to calculate yield and costs of processing</td>
</tr>
<tr>
<td>5</td>
<td>Pass the pieces through the pulper extractor</td>
<td>Heat water in a large pot and blanch the pandanus pieces for 2 minutes (It is ideal to steam blanch)</td>
<td>Blanching is a MUST for every fruits and vegetables that are to be processed. The aim is to cease the enzymatic activity in the fruits to improve quality and reduce spoilage of product</td>
</tr>
<tr>
<td>6</td>
<td>Collect the pulp and remove the fibre</td>
<td>Drain well and cool immediately in clean cold water</td>
<td>Must use only cold clean water</td>
</tr>
<tr>
<td>7</td>
<td>Pass the pulp through the centrifuge</td>
<td>With gloved hands pass the pieces through the pulper extractor</td>
<td>Good hygienic practices must be followed at all times</td>
</tr>
<tr>
<td>8</td>
<td>Collect juice and remove paste from the screen cloth</td>
<td>Retain the first fibre extract and pass it again through the extractor</td>
<td>There is still a lot of juice left from the first extract, (abs 27%)</td>
</tr>
<tr>
<td>Step</td>
<td>Description</td>
<td>Special Instructions</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Pack into bottles (285ml juice and 60ml water)</td>
<td>Weigh the juice and record weight. Weighing and recording must be carried out at all times.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Count the number of bottles and Freeze</td>
<td>Pass through the centrifuge and weigh the extract and residue and record. Screening cloth must be clean and checked thoroughly before use.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Clean up and close up.</td>
<td>With clean and gloved hands, use sterilized jars and funnels, fill water (60ml) on labeled clean bottles and fill in juice, screw cap tightly and store in freezer. Hygienic practices is vital to be followed when manually filling of finished products.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>OR formulate required juice concentration as in the formula provided, pasteurize to 85 deg C for 15 seconds, cool immediately to 45 deg C and fill in sterilized labeled bottles, cap tightly and store at 4 deg C. Shelf life 14 days.</td>
<td>Juice can be sterilized for longer storage life.</td>
<td></td>
</tr>
</tbody>
</table>

The processing steps of pandanus fruit juice is similar to any other fruit juice processed. What is important that fruits must be blanched first before extraction and juice must not be left open in the tub for too long. It is recommended that as soon as the juice is ready for bottling it is packed straight away to avoid unnecessary oxidation that will spoil the juice quality. Because the process is half-mechanical and manual, it is important that the workers adhere to hygienic standard practices at all times.

3.3 Product Development Activities at RRE

Product development is the testing of new product formulations with available materials, ingredients and machine, assessing the product quality, consumer preferences on physical and organoleptic characteristics, etc until the product produced is acceptable by majority number of consumers and longer shelf life is maintained.

Some difficulties encountered during the period of consultancy,

i) non availability of some ingredients required for product development in the Marshalls
ii) non availability of standard measuring equipment, like the pH meter and refractometer
iii) very slow response to request on required cooking accessories and utensils and basic ingredients. (only a small food warmer was supplied as larger pot was used for blanching pandanus, no cooking spoon or utensils and also had to make do with the factory balance and in most cases had to spend own money to purchase ingredients because of the delay and non response of requests. (money spent was later refunded)

However products that were produced using the basic ingredients are as follows

a) Pandanus juice of varying concentration:
   - 35% (the standard commercial level)
- 40 % which is now increasing in demand in Thailand
- 60 % and the
- 80 % which is RRE product

**Table 2: Formulation for pandanus juice**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>35% pandanus juice</th>
<th>40% Pandanus juice</th>
<th>60% pandanus juice</th>
<th>86% pandanus juice(normal RRE product)</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>1.52L</td>
<td>1.875L</td>
<td>1.33L</td>
<td>325.5ml</td>
</tr>
<tr>
<td>Pandanus pulp</td>
<td>1L</td>
<td>1.5L</td>
<td>1.6L</td>
<td>2L</td>
</tr>
<tr>
<td>sugar</td>
<td>1 1/3</td>
<td>1 ½ cup</td>
<td>306g</td>
<td></td>
</tr>
<tr>
<td>Lemon juice</td>
<td>1 cup</td>
<td>1 ½ cup</td>
<td>400ml</td>
<td>500ml</td>
</tr>
<tr>
<td>Output</td>
<td>8 ½ bottles x 340ml</td>
<td>11 ½ bottles x 340ml</td>
<td>7 ½ bottles x 340ml</td>
<td>6 ½ bottles x 340ml</td>
</tr>
</tbody>
</table>

The process is similar for different concentrations which involved mixing of all ingredients together and heating to 75-85 deg Celcius for 15 seconds and cooling immediately. Pack in sterilized bottles and seal properly and label. Store at 4 deg C. Storage life is expected to be 2 weeks provided the storage conditions remains the same.

NB. Pandanus juice and water quantity can be varied to suit ones taste.

**b) Pandanus Nectar**

- Water 3.74L
- Pandanus pulp 2 L
- Sugar 570g
- Lemon juice 2 cups

Mix all ingredients together and pass through the colloid mill until reach a smooth texture then heat to 75–85 deg C for 15 sec, cool immediately and pack into sterilized bottles and store at 4 deg C.

**c) Pandanus Jam**

- Pandanus pulp 1.5 kg (residue from centrifuge)
- Sugar 1.5 kg
- Lemon juice 200ml

Mix pandanus pulp and sugar and heat until boils than simmer, add lemon juice mixing all the time until the right thick consistency is reached. Cool immediately and fill in the factory plastic cups an seal well or if glass bottles are available fill hot and seal lid immediately and placed upside down and cool at room temperatures. Output 8 cups x 340 g
d) Pandanus Syrup

Pandanus pulp  1.5 Kg (residue from centrifuge)
Water  1 L
Sugar  1.5 kg
Lemon juice  200ml
Corn flour  150g (mixed with water to gain smooth consistency)

Mix pandanus pulp, water and sugar together and heat to boil and simmer mixing all the
time, add lemon juice and continue heating and mixing, add the mixed corn flour slowly and
mixing thoroughly all the time until thick consistency is formed. Pack hot into sterilised
bottles, Cool and store at room temperatures. If packing in plastic cups, cool to 45 deg C
and pack, seal and cool at room temperatures. Output 5 ½ cups x 340g

e) Pandanus leather - two types, hard and soft texture

Pandanus pulp  1.5 kg
Benzoic acid  1 teaspoon

Mix all the ingredients together and heat until boiling, continue to mix and boil for further
5 mins and pour hot onto foil tray and place into dehydrator and heat at 145 Deg C for 18
hrs. Remove and cool and with a wider flat knife and gloved hands, remove from tray and
roll onto grease paper. Store at keep at room temperatures. Sliced into pieces when
serving to eat.

For the dried texture leather, pour the mixture thinly onto greased paper and placed in the
dehydrator and dry at 145 Deg C, or until firmly dry. Cool and with clean gloved hands
remove from grease paper and pack into zip lock bags and store at room temperatures.

f) Pandanus Baby Food

Water  800ml
Pandanus pulp  1.5 kg (residue from Centrifuge)
Milk powder (creamer)  800g
Lemon juice  100ml

Mix all ingredients together and heat to boil, keep stirring all the time, simmer for and cook
for 15 minutes, cool to 45 deg C and pack in the plastic cup and seal immediately. If
sterilized glass bottles are available pack hot and seal immediately and cool at room
temperatures. Output 7 ½ cups x 500ml

g) Pandanus coconut bar

Pandanus pulp  2 ½ kg
Freshly Grated coconut  2 nuts
Sugar  750g
Coconut cream 1 cup
Lemon juice 200ml
Glutinous rice 1-1 ¼ cup
Sodium Benzoic acid 2 teaspoon
Water to mix glutinous rice

Mix all ingredients, except glutinous rice, together and bring to boil, continue boiling and mixing and add slowly the glutinous rice and mix well until very thick. In consistency, cool and pour into tray and bake at 180 deg C until firmly dried. Remove and cool and cut in to pieces or bars when serving.

h) Pandanus dried pieces – that can be reconstituted when required for later use or can be chewed as is.

Cut blanched pieces into small thin strips and weigh and record wt. Place on drying trays. Turn on the Dehydrator and heat at 45 deg C for 18hrs or until pieces are properly dried. Remove from dehydrator and cool and pack in the zip lock plastic bags and weigh and record wt. Store at cool temperatures.

i) Dried Pandanus fibre – from the first extract that can be reconstituted for juice or pounded and grinded into powder form after sieving and blended with water for drink or mix with flour for bakery purposes.

4.0 Consumer Survey

The total number of consumers that took part in the taste panel was 41, of these more than 90% of the tasters were non-Marshallese, mainly the Americans, Asians from Japan, Taiwan, Thailand and Chinese, some Melanesians, Fiji, Vanuatu, Solomon’s and Samoa and other Polynesian.

From the table 2 below, it is obvious that the highest preference was the Pandanus nectar.

However, with the different pandanus juice formulations, the top choice most was the 35% juice concentration, second was the 40% and 60% juice concentration. The 86% concentration was too strong for most people.

So RRE can still produce the 86% juice concentrate for the local consumers but definitely a milder flavour for the overseas markets and visitors.

Pandanus nectar definitely has a place in the market.

**Table 3: Consumer Survey Results of Pandanus Juice**

Results of Product Survey Carried out during Pandanus Festival:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample C</th>
<th>Sample D</th>
<th>Sample E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Accept</td>
<td>16</td>
<td>13</td>
<td>24</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>13</td>
<td>11</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>----------------------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Moderately Accept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slightly Accept</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Neither/Nor Accept</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Slightly Unaccept</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Moderally Unacc</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Unacceptable</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Comments from tasters:
- Very good, sweet
- sweet tangy, very	tangy, bit of after taste
- taste better	but refreshing
- good taste	mildly sweet
- unique taste, strong not
taste so good
- overpowering
- very good	very good balanced
- light & refreshing
taste so good
- more balanced
good taste, good content
- strong taste
- heavier mouth feel
- refreshing
- good best taste
- very good, my favorite
- too thick and sweet
- like mango juice
- too strong for me
- almost like C
- really don’t like it
- bit bitter
- very fruity, sweet
- earthy taste
- not delicious

Sample A 35% pandanus fruit juice,
Sample B 60% Pandanus juice
Sample C is the pandanus nectar
Sample D is the 40% pandanus juice
Sample E is the normal juice processed at the factory, the 80% pandanus juice

5.0 Guideline to Commercial Pandanus Processing

This is a guideline to the commercial processing of pandanus products when the necessary ingredients and quality standard equipment are available.

5.1 Selection of fruits

a) Before processing ensure that all equipment to be used are thoroughly clean and ready
b) Weigh selected pandanus bunch or keys that meet the specification criteria, record weight in the daily processing log book, note date and time and list workers involved.

5.2 Washing

a) Fill up portable water in the sink provided and wash pandanus thoroughly well.

Remarks: Use portable water only.
5.3 Cutting or Trimming

a) Fill up s/s trays and place on the s/s table. Using s/s sharp knives or trimmers, trim ripe portion of the fruit and weigh, record weight.

5.4 Blanching

a) Bring the water to boil in the pot (blancher) and blanch the pandanus pieces for 2 minutes.
b) Drain well by lifting up the perforated basket and let it stand for 5 minutes to drain out excess water.

Remarks: Use portable water only.

5.5 Pulping

a) Check the pulper or juice extractor and ensure it is clean and nuts and bolts are tightly in place.
b) Ensure that the receiving plastic tub or s/s tray is placed well below the outlet to receive pandanus pulp.
c) Turn on power and pass the pandanus pieces through the pulping machine, small amount at a time, be careful not to jam the pulper.
d) Collect pulp, weigh and record weight on log book or production sheet (refer example).

Remarks: The fibrous pieces that are extracted out are still wet which indicate it still has a lot of juice, so a double extraction is recommended to gain as much juice as possible.

5.6 Screening and Separating

a) Check the Separating and Screening Machine (centrifuge) and ensure it is clean and all nuts and bolts are tightly in place, check screening cloth and ensure this is always cleaned thoroughly and dried before use.
b) Place a clean receiving s/s tray at the outlet to receive juice.
c) Turn on power and pass the pandanus pulp slowly through the centrifuge.
d) Collect the juice, weigh and record.
e) Take a sample and check pH and Brix and record.
f) Collect the solids and weigh and store in the freeze for later use into other baby products etc.

5.7 Remarks and Recommendation

The juice is then further processed into juice, nectar or jams or preprocess for freezing and use at a later date.
6.0 Preprocessing of Pandanus Pulp

a) Weigh and record weight of pulp and pour into the Evaporator (Cooker)
b) Consult engineer to operate cooking pot (double cooker)
c) Turn on heating and apply heat to pulp until reaches 85 -90 degree C and let it be heated for a further 15 sec, stirring continuously, then allow to cool to 45 degree C before packing into food grade plastic buckets or plastic bags for freezing and use at a later date.
d) Cool buckets immediately in a tub of cold running water.
e) Weigh and record.
f) Label well, the product name and type of product, batch number, date, time and weight,
g) Measure pH and Brix and record.
h) pH of pandanus pulp average of 4.3 and Brix and average of 14
i) Place buckets in Freezer (-18 to -25 degree C)
j) To export frozen pulp, add citric acid while processing to reduce pH level to 3.5 or lower and ascorbic acid to improve quality and maintain good colour during processing.

6.1 Remarks and Recommendation

a) When packing hot product into plastic bags and plastic buckets, allow the product to cool first to about 45 degree C and then fill. To avoid burning and collapsing of plastic buckets and bags allow the receiving containers to be placed on clean cold water while being filled and after filling for proper cooling before placing it in the freezer.
b) This practice can be carried out in the islands to avoid high product losses through transportation and to ensure the freshness of produce is still maintained when delivered to the processing plant.
Figure 1: Pandanus Processing

Reception

Sorting

Weighing & Record wt

Washing

Trimming

Weighing

Blanching

Pulping

Screening

Weighing

Pre-Process

Juice Processing

Nectar Processing

Jam Processing

Sauce Processing

Other Products

Pack & Label

Freeze
7.0 Processing of Pandanus Juice

7.1 Ingredients Listing:

Basic formulation that was used for product development:

Water 53.0 %
Pandanus pulp 35.0 %
Sugar 11.5%
Citric acid 0.35%
The pH level to be equal or less than 3.5

7.2 Remarks

a) pH of juice to be <3.5
b) Measure pH and Brix of pulp before mixing and then after mixing, before heating.
   Adjust pH level if need be by slightly increasing citric acid level

7.3 Materials required:

Weighing balance
pH meter
Refractometer
Thermometer
Bowls or basins for weighing ingredients
Spoons
S/S trays
Packaging bottles and lids
Gloves

7.4 Processing steps

a) Check all ingredients and ensure all are available in quantity and quality.
b) Check all packaging materials and ensure all are cleaned with no damages.
c) Check all equipment and ensure all are in working order and are cleaned, liaise with Engineer
d) Weigh all ingredients (refer formulation, work out weights from percent values).
   for juice must be around 3.5 before heating)
f) Heat juice in the evaporator, stirring the juice all the time
g) Pasteurize the juice by heating to 85-90 degree C and holding at that temperature
   for 15 seconds, keep stirring all the time
h) Turn off steam or heater but keep the stirrer on.
i) Allow to cool to 45 degree C, put on the gloves and then fill in PET bottles and close tightly. PET Bottles are to be filled while partly submerged on the clean cold water bath.
j) Place in the cooler for storage.
7.5 Remarks and Recommendation

a) If glass bottles with proper lids are available, then the juice can be filled hot at 85 degree C, close lids tightly and cool immediately in a water bath.
b) Ingredients are listed in % value, so anyone can work out easily the formula for whatever amount of juice one wants to prepare.
c) Measure the pH and brix before and after heating and record.
   Yield is expected to be 95% of initial volume.

7.6 Comments: Check acceptability in sweetness, colour, acidity level (pH) and smoothness of juice.

7.7 Sterilisation of Pandanus Juice

Follow procedure as above and using glass bottles and heat resistant packages.

   a) Pasteurise juice to 85 -90 degree C for 15 seconds, fill hot and close bottles loosely.
   b) Subject bottles in to a hot water boiling bath and heat for 30 -45 minutes.
   c) At the end of heating, remove bottles, close lid tightly, place in a warm water bath before introducing cold water and cool quickly. Ensure that bottle mouth is not submerged.
   d) Remove after cooling, dry well, label and store in cool dry place.
   e) Withdraw reference samples for test and future storage references.

8.0 Processing of Pandanus nectar

Basic formulation that can be used for product development:

8.1 Ingredients:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>55.8%</td>
</tr>
<tr>
<td>Pulp</td>
<td>35.2%</td>
</tr>
<tr>
<td>Sugar</td>
<td>8.5%</td>
</tr>
<tr>
<td>Citric acid</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

8.2 Materials required:

- Weighing balance
- pH meter
- Refractometer
- Thermometer
- Bowls or basins for weighing ingredients
- Spoons
- S/s trays
- Packaging bottles and lids
- Colloid mill
- Finer screen separator
- Hot gloves
8.3 Processing steps

a) Check all ingredients and ensure all are available in quantity and quality.
b) Check all packaging materials and ensure all are cleaned with no damages.
c) Check all equipment and ensure all are in working order and are cleaned, liaise with Engineer.
d) Weigh all ingredients (refer formulation, work out weights from percentage values).
e) Mix all ingredients together and pass ingredients through the colloid mill and blend for 2-3 mins
f) Pour the mixture into the evaporator, measure pH and Brix and record (pH for nectar must be around 3.5 before heating)
g) Heat nectar slowly in the evaporator, stirring the mixture all the time
h) Pasteurize the nectar by heating to 85-90 degree C and holding at that temperature for 15 seconds keep stirring all the time
i) Turn off steam but keep the stirrer on.
j) Allow cooling to 45 degree C and then using the hot gloves, open the valve at the bottom of the cooker and fill into sterile jugs.
k) Using the jars then fill in PET bottles and close tightly. PET Bottles are to be filled while partly submerged in the clean cold water bath.
l) Once cooled, drain well and dry the bottles.
m) Label the bottles and store in a cool storage.

8.4 Remarks

a) If glass bottles with proper lids are available, then the juice can be filled hot at 85 degree C, close lids tightly and cool immediately in a water bath.
b) Ingredients are listed in % value, so anyone can work out easily the formula for whatever amount of juice one wants to prepare (refer examples in the appendix).
c) Record pH, Brix before and after heating,
d) The nectar should be very smooth, sweet and of thick smooth texture
Yield or Output is expected to be 80% of total volume

8.5 Comments: The nectar produced should be checked for thickness, smoothness and should be moderately sweet and have a good acidic touch.

8.6 Remarks and recommendation:

a) Nectar can be re formulated to have reduced pulp quantity to 30%, if consumers find the nectar too thick. For commercial purposes, this would be advisable to gain more output from the pulp.

Water 55.8%
Pulp 30%
Sugar 8.5%
Citric acid 0.5%

b) The pandanus pulp is very sweet, so sweetness is not affected and pH level to be within pH 3.5. The smoothness to be maintained but thickness reduced slightly but should still maintains good body texture.
8.7 Sterilization of Pandanus Nectar

Follow procedure as above and using glass bottles and heat resistant bottles.

a) Check all ingredients and ensure all are available in quantity and quality.

b) Check all packaging materials and ensure all are cleaned with no damages.

c) Check all equipment and ensure all are in working order and are cleaned, liaise with Engineer.

d) Weigh all ingredients (refer formulation, work out weights from percentage values).

e) Mix all ingredients together and pass ingredients through the colloid mill and blend for 2-3 mins

f) Pour the mixture into the evaporator, measure pH and Brix and record (pH for nectar must be around 3.5 before heating)

g) Heat nectar slowly in the evaporator, stirring the mixture all the time

h) Pasteurize the nectar by heating to 85-90 degree C and holding at that temperature for 15 seconds keep stirring all the time

i) Fill hot in glass bottles and close bottles loosely.

j) Subject bottles in to a hot water boiling bath and heat for 30 -45 minutes. Ensure that hot water level is at the bottle neck.

k) At the end of heating, remove bottles, close lid tightly, place in a warm water bath before introducing cold water and cool quickly. Ensure that bottle mouth is not submerged. Remove after cooling.

l) Dry well, label and store in cool dry place.

m) Withdraw reference samples for test and future storage assessment.

9.0 Processing of Pandanus Jam

9.1 Basic formulation that was used for product development:

Ingredients:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>33.3 %</td>
</tr>
<tr>
<td>Pulp</td>
<td>33.3%</td>
</tr>
<tr>
<td>Sugar</td>
<td>33.3%</td>
</tr>
<tr>
<td>Citric acid</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

9.2 Materials required:

- Weighing balance
- pH meter
- Refractometer
- Thermometer
- Bowls or basins for weighing ingredients
- Spoons
- s/s trays or buckets
Packaging bottles with lids
A pair of (hot) gloves

9.3 Processing steps

a) Check all ingredients and ensure all are available in quantity and quality.
b) Check all packaging materials and ensure all are cleaned with no damages.
c) Check all equipment and ensure all are in working order and are cleaned, liaise with Engineer.
d) Weigh all ingredients (refer formulation, work out weights from percentage values).
e) Mix all ingredients together, measure the pH and Brix and record, (pH for pandanus jam mixture must be around 3.5 before heating)
f) Pour the mixture into the cooking pot, turn on the heat.
g) Heat the jam mixture slowly in the pot, stirring the mixture all the time
h) Keep on heating the mixture until it starts to boil then simmer by reducing heat
i) Continue to stir and heat slowly, measuring the brix level constantly. When the Brix reading reaches 63 degree brix, turn off the heat but keep stirring.
j) Assemble the jam empty bottles on a tray, open the valve beneath the evaporator (outlet) and using the hot glove, commence filling the jam in the bottles one by one.
Care must be taken so as not to burn.
k) Fill the jam right to the neck of the bottle and close the lid immediately.
l) Turn the bottle upside down to sterilize the space above the bottle.
m) When cool turn the bottle upright again and wash off any jam spills on the bottles.
n) Label and store in cool dry place.

9.4 Remarks

a) pH reading before heating and after should be within 3.5 or less Brix reading, after heating should be around 65 degree Output expected approximately 55%.
The jam is normally sweet, smooth and easily spreadable with a good colour and texture.

10.0 Pandanus Fruit Leather

10.1 Ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandanus Pulp</td>
<td>60.0%</td>
</tr>
<tr>
<td>Sugar</td>
<td>25.0%</td>
</tr>
<tr>
<td>Water</td>
<td>15.0%</td>
</tr>
<tr>
<td>Sodium Metabisulphite (SMS)</td>
<td>0.1%</td>
</tr>
<tr>
<td>Potassium Sorbate</td>
<td>0.05%</td>
</tr>
<tr>
<td>Guar gum</td>
<td>0.015%</td>
</tr>
</tbody>
</table>

10.2 Materials/Equipment Required

Measuring jug
2 Cooking pots, a large and a smaller size
Gas Stove
Sterilise s/s trays
Weighing balance
Oil
pH meter
Refractometer
Thermometer
Bowls or basins for weighing ingredients
Spoons
Hot gloves

10.3 Processing Steps

a) Check all ingredients and ensure all are available in quantity and quality.
b) Check all packaging materials and ensure all are cleaned with no damages.
c) Check all equipment and ensure all are in working order and are cleaned.
d) Weigh all ingredients (refer formulation, work out weights from percentage values).
e) In the small pot, mix the SMS and water thoroughly; ensuring all SMS particles is dissolved before mixing with other ingredients.
f) Pour the rest of the ingredients in to the smaller pot and mix thoroughly together

10.4 Remarks:

Pandanus leather has a bright attractive natural deep orange colour, sweet taste, good soft texture with the right elasticity, easily rolled and holds well. A good snack for children.

11.0 Guideline for Hygienic Practices in the Factory Plant

11.1 Personal Hygiene

11.1.1. Health Status of Personal

a) The health status of the worker at the processing plant is of prime importance.
11.1.2 Hygiene of Personal

a) Every person working and handling food is to maintain a high degree of personal cleanliness and to wear suitable, clean and where necessary protective clothing.

b) The person handling processed food and juice are to be in good health.

c) NO person suffering or recognized and suspected of being affected by an illness which can be transmitted through the food product or who has, for example infected wounds, skin diseases or infections, sores or is suffering from diarrhea or cold is authorized to work in any position as long as there exists a direct or indirect probability of contaminating the food with pathogenic bacteria.

d) The personnel is to wear protective clothes like footwear and hairnets where and if appropriate.

e) The personnel must wash his or her hands thoroughly using soap and water prior to commencing work activities and after visiting the toilet. Hands and arms must be dried thoroughly with a hand towel or paper towels.

f) It is required that all personnel remove all jewelry (except plain wedding rings) before engaging in the handling of food products, fruit, pulp, juices, chips, powder and leather.

g) All personnel to wear protective footwear appropriate to the type of processing. Bare feet are not allowed.

h) The use of paper towels are allowed for drying of hands after washing and these paper towels must be discarded properly in a closed container.

i) A first aid kit is to be available at the factory.

j) Smoking is not allowed in the factory and on the factory premises. The management might allow smoking in a designated area.

k) Personal have passed basic training on personal hygiene (Records are available)

11.2 Hygiene of the Infrastructure

11.2.1 Hygiene of the Indirect Environment

Definition: The Indirect Environment is outside the factory premises

a) The factory is located in a clean environment free of contamination from this environment. If not, the Food Committee or management has to take essential measures to avoid any contamination.

b) The management and the is to be aware of the industrial of agricultural activities of the neighbor and ensures there is no possibility of any possibility of any contamination from these neighboring activities.
11.2.2. Hygiene of the Direct Environment of the factory or food processing plant and premises.

Definition: The direct or immediate environment is on the factory premises.

a) The direct or immediate environment is free of obsolete materials like old equipment, timber, wood, used bottles and sacks.

b) The direct or immediate environment of the factory is maintained in good order, this means the grass is cut, free of products and product residues, paper, glass or any other material.

c) The factory has a minimum of plantation growth on the premises and plants growing against the factory wall are not permitted.

d) The premises have proper drainage to ensure the factory cannot be flooded during high rainfall.

e) The factory has enclosed containers where waste materials are collected.

f) Waste containers are placed at a distances from the processing equipment to prevent any cross contamination.

b) Cats and dogs are not allowed in the factory or on the factory premises.

h) Other animals are not allowed on the factory premises and the direct environment of the premises.

i) Manure of animals, pigs, dogs and cats if found should be removed and not cause any source of cross contamination on the premises.

j) Pandanus waste is to be dumped at such a distance that it does not pose a risk to the environment where food processing is carried out.

11.3 Design of the building

a) The building and facilities are to be of adequate size for the handling and processing of the pandanus food products and the processing of these food products and storage of the finished products.

b) The processing and storage rooms have sufficient ventilation preferably openings at opposite walls.

c) The ventilation openings are protected with insect proof screens to prevent the entrance of flies and pests.

d) The wall surfaces are made of impervious, non-absorbent, washable, durable and non-toxic materials and require a smooth surface up to a height appropriate for the operations.

e) Wooden walls are not allowed.

f) The processing floors both inside and outside the buildings are made of concrete.

b) Floors are either covered with tiles, properly plastered concrete or made of a coating suitable for the purpose of processing pandanus juice and products.

h) Damaged concrete or tiles where dirt and water collect are not allowed.

i) Door entrances have concrete floorings. Sand or unpaved entrances are not allowed.

j) Tiles if applied are of sufficient height to suit its purposes.

k) Floors can be covered with a protective coating.

l) Windows to be constructed to prevent accumulation of dirt. Windows that can be opened are to be fitted with insect proof screens.

m) Doors are made of smooth and non absorbent materials and easy to clean.
n) Wooden beams for construction purposes have no signs of infestation of wood-worm.
o) Steel beams have no sign of rust.
p) Washing and rinsing water is drained off from the factory floor and building through appropriate drains.
q) The floor has a proper slope to avoid ensuring NO water residues remain.
r) The floor surface is smooth, well plastered and without cracks so that water and product residues cannot remain trapped.
s) The floor has proper drains without cracks so that water and products residues cannot remain behind.
t) Floor drains have proper protection to prevent entrance of pests from outside.
u) The factory has adequate number of flush toilets and is not open directly into the room in which food is handled.
v) Sanitary conveniences are to have adequate natural or mechanical ventilation.
w) Adequate number of washbasins with cleaning soap is available, suitable located and designated for cleaning hands.
x) Handling and processing of pandanus fruits and other food products and storage of the final products can be in the same building provided there is a logical sequence of the flow of processing and there is no possibility of cross contamination.
y) Lamps are at such height that there is no possibility of damage and the lamps are protected with cover.

11.3.1 Remarks and recommendation

a) Door entrance from outside to have concrete flooring to avoid sand and dirt being transferred to the factory floor.
b) Round edges at the floor connecting the floor and the walls and in drains are recommended to facilitate cleaning.
c) Wooden walls to be replaced by concrete at least 2 ft from the floor
d) For safety purposes, label all power switches especially for the boiler.
e) The factory should not be attached to the main office building because of high risks of insect infestation (rats and cockroaches).
f) The factory is also too near the old containers and mechanical workshop, high risk of contamination.

11.4 Hygiene of the Building and Department

a) All the departments in the factory area are free of cobwebs, free of moldy spots, free of rusts, no signs of pests, no sign of infestation and the department are clean.
b) The departments are free of structural condensation.

11.5 Hygiene Design of Equipment and Tools

11.5.1 Processing Equipment

a) Lubricants or grease for the lubrication of the processing equipment with the possibility to be in direct contact with the fruits and or use are food grade and certificates stating Food Grade are available.
11.5.2 Storage tanks, containers and other recipients
   a) Those parts of the Processing Equipment coming into direct contact with the pandanus juice and other food products are made of a durable food grade plastic or stainless steel.
   b) The factory can demonstrate certificates of food grade quality of the plastic materials.

11.5.3 Material Specifications of the details and smaller tools
   Improper materials used for food contact surfaces may allow migration of deleterious substances, impart off flavors and colors, or may absorb food materials and become a source of contamination.

   a) Surfaces in contact with fruits, juices and other food products are either stainless steel, Non Toxic Food Grade materials or nylon.
   b) Those parts made for the separating screens in the pulper, perforated baskets for washing of fruits and perforated for blanching are made of stainless steel.
   c) The materials for the drying racks in direct contact with fruits and food are made of food grade materials such as plastic, nylon or stainless steel.
   d) Drying frames are maintained and have no sign of rust.
   e) Equipment and tools like containers, paddles and buckets are made of wood, durable plastic and stainless steel.
   f) Drying racks have no sign of rust.
   g) Sieve is made of stainless steel.
   h) Tables are of stainless steel materials.
   i) Household materials are allowed provided they are in good condition, clean, without cracks, without damages and not worn out.
   j) Cleaning materials are made of durable plastic materials and can be washed out in hot water if necessary.
   k) Aluminum containers are not allowed.
   l) Steel brushes and other cleaning material made of steel are not allowed.
   m) Plastic containers are suitable for its purposes; household materials should not be used for industrial purposes.

11.6 Water Quality

   a) For processing, cleaning and rinsing only portable water is to be used
   b) With town water, a certificate of analysis on yearly basis
   c) Rain water used for processing is subject to chlorination or the management to demonstrate the water is portable by subjecting microbiological and chemical analysis at least on a yearly basis or otherwise, Records are maintained.
   d) Well water used for above purposes to be subject to microbiological and Chemical analysis to be carried out at least twice yearly. Records are maintained.

11.6.1 Remarks and Recommendation.
a) If any well water is used, it is to be used only for washing of the floor.
b) When well water is used for washing equipment it must be thoroughly rinsed with boiled rain water or town water.
c) Rain water is to be boiled before using it for rinsing equipment and cooling processed products.
d) Proper labeling of outlet to distinguish rain water from well water is to be carried out.
e) Rain water used for processing must be thoroughly filtered before use.

11.7 Pest and Rodent Control

a) Pest and rodents (in particular flies) are controlled through maintaining a clean and dry environment.
b) Obsolete materials are absent inside the factory and outside the factory in the direct neighborhood of the processing facilities.
c) Windows are equipped with appropriate mesh to protect from incoming pests.
d) Ceiling and wall gaps and holes are covered to avoid entry of rodents.
e) Doors are securely closed with appropriate mesh to prevent entry of pests.
f) Processing areas with open space (in particular receiving area of raw materials) Take immediate action to ensure absence of bee and wasp nests

g) Open baits are not allowed
h) The management must demonstrate due diligence in the control of pests.
i) Rodent and mice baits are used, if necessary
j) Fly lamps or insectocutors are to be used if necessary and maintained and cleaned at regular intervals
k) A checklist is in place (record)

11.8 Cleaning and Sanitation

a) The factory and the premises are to be kept clean
b) The factory, inside and outside in the direct neighborhood of the processing facilities and its premises are to be free of any obsolete materials
c) The management is to demonstrate due diligence to keep the factory clean; establish a cleaning schedule, working instructions and a checklist.
d) The cleaning schedule documents the subjects which need to be cleaned and kept clean. This cleaning schedule indicates what needs to be cleaned, how, the frequency, methodology and detergent and sanitizing method (See example of cleaning schedule).
e) Cleaning and sanitizing agents are not to be stored where food is handled.
f) A checklist is in place to ensure hygiene and cleanliness (record.)
g) Cleaning and sanitizing agents are properly identified.
h) Unidentified containers containing cleaning agents are NOT allowed.

11.9 Organic Waste Materials and/or by products

a) The waste materials from Pandanus are largely contributed from the green outer inedible portion and fiber after screening. This if dry enough make good materials for compost.
b) The compost is to be made at a distance from the processing factory.
c) Unsuitable waste is to be discarded at sufficient distances from the premises to prevent any contamination to the factory.

11.9.1 Other Waste Materials

a) Any other waste products like cans, plastics, paper, glass and PET bottles is to be discarded properly.
b) Waste materials are to be temporarily stored in enclosed containers.
c) The factory and factory premises are to be free of waste materials.
d) Waste facilities and tools are to be cleaned and maintained on a regular basis.

11.9.2 Waste water

a) There must be no signs of waste water and water residues in and around the factory.

11.9.3 Others

a) The use of glass mercury thermometers is not allowed.
b) Broken glass windows is not allowed.

11.11 Training

a) The local counterparts and workers have been trained on Personal Hygiene, Factory Hygiene, Product Development and Pandanus juice Processing, Food Preservation, Consumer Survey.
b) Training of staff is to be documented; the content of the training, the trainer, date and the participants.

12.0 Production and Processing of Pandanus Products.

The processing guideline is the result of the discussion and brief training within the 2-4 weeks the consultant was engaged in on Product Development, Fruit Juice processing and the Drafting of the Marketing and Business plan for the factory plant. This has been incorporated with Quality Control, Quality Assurance and HACCP to assist the management.

13.0 Harvesting of Pandanus

13.1 Pandanus,

a) Pick only three quarter ripe pandanus,
b) Do not pick pandanus keys that have fallen on the ground. These contain dirt and might contain larvae of the fruit fly.
c) When picking pandanus, avoid the use of sticks which will damage the fruits and avoid dropping the fruits on the ground which will result in bruising.
d) Do not use green immature or damaged and bruised fruits.
e) Do not use fruits that are moldy or infected with insects.
13.2 Harvesting

a) During harvesting, pigs and dogs must not be allowed near the produce to avoid contamination through animal waste.

b) The source of the fruits is recorded to ensure traceability. Records are in place.

c) Pickers and those involved in harvesting and primary handling of fruits are made aware of the quality aspects of the fruits through awareness programs e.g. training and product specification leaflets.

13.2.1 Remarks and Recommendation

a) Producers are to be made aware of the harvesting practices and product specification required by the food processing plant.

13.3 Produce Packaging

a) Clean plastic tubs, crates, cartons or bags are allowed.

b) Unclean used bags (jute, plastic), containers, crates from unknown sources are not allowed.

c) Perforated containers and crates are recommended to allow good air ventilation.

13.4 Transportation

a) The produce must be handled with care, no throwing or crushing or used for seating during transportation.

b) The produce must be covered to avoid contamination from the environment.

c) Care must be taken for fruits being transported from the farms; it must arrive at the factory wholesome.

13.4.1 Remarks and Recommendation

a) For fruits, pandanus, that are to be supplied from the farms and outer islands; farmers are trained to know of the quality of the produce required.

13.5 Raw Material Processing

13.5.1 Reception and Sorting

At the collection point at the processing plant the raw materials are checked according to the following criteria as per raw material specification.

a) Only good wholesome produce is allowed

b) Immature pandanus, bananas and breadfruit are not allowed.

c) Overripe fruits are rejected. Overripe fruits are likely to have more yeast causing fermentation that will affect product quality taste.

d) Damaged, open and bruised fruits are rejected

e) Twigs and leaves, dirt and soils are removed

f) Some samples are tested for pH and Brix of the fruits. Information is recorded for the
supplier.
Results are recorded.
g) Traceability starts and the respective suppliers are recorded. A number of farmers, a
district or Island can represent.
h) Packaging materials are checked upon arrival according to the required
specifications.
i) The source of the produce/fruits is recorded to ensure traceability.
Records are in place.
j) Weigh the accepted produce for processing. Record weight for payment.
k) Weigh the rejected produce/fruits, record and communicate with the supplier or
agent and agriculture officer.

13.5.2 Washing

a) The fruits are washed manually with portable water.

13.5.3 Peeling, Trimming and Cutting

The produce are peeled or trimmed and cut into small pieces and weighed. Record weight.

13.5.4 Blanching

Produce after trimming (applies to pandanus) are blanched in boiling hot water and drained well

13.5.5 Pulping and screening

Hygienic conditions and Good Manufacturing Practices are applied.

13.5.6 Pasteurization

a) Pasteurization can be flash pasteurization or open pot pasteurization

b) For the pandanus juice, open type pasteurization is carried out at 85 -90 degree
C degree C for 5 min -10mins (note time is increased in this situation because water used as ingredient
is not portable at the factory and water used for washing is well water). Until and when portable water
is supplied to the factory and all hygienic standards are complied (less handling) and then pasteurization
time is to be reduced to 15 seconds.

c) Keep records.

d) Pasteurization is a CCP so pasteurization must be carried out as per instruction documented attached

13.5.7 Cooling

a) Pasteurized product is cooled openly to 45 degree C before filling because plastic bottled (PET)
are used. Cooling must be carried out as quickly as possible. Filled bottles are placed in a basin of
clean cold water bath; ensure the top end of the bottle is not submerged.
13.5.8 Filling

a) Empty bottles and lids must be sterilized and kept dry in a cool clean place before use

b) Hygienic practice must be applied when filling.

13.5.9 Sterilization

a) When glass bottles or heat resistant packages are used, the pandanus juice is pasteurized to 85 degree C for 5 seconds, filled hot into glass bottles or other heat resistant packages, closed loosely and then subjected to a hot water boiling bath for 30 mins. Bottles are closed tightly and cooled immediately by first dipping in warm water and then cold water.

b) Sterilization is a Critical Control Point (CCP), so sterilization must be carried as documented.

c) Bottles are dried thoroughly, labeled and packed in cartons

13.6 Storage

a) Products are stored in a cool dry place.

b) Reference samples are withdrawn from each batch and stored separately for future reference and tests. Number of samples withdrawn depends on the batch size, 4 bottles is recommended for the small batch at the factory.

13.7 Labeling

i) Ensure label requirements are met.

Name of company
Country of Origin
Botanical Name
Common name
Batch or Lot Number
Manufacturing date
Use by Date
Volume or Weight
Storage Conditions
Instruction on how to use the product

13.8 Dispatch

Ensure the packages are labeled well with appropriate information.

13.9 Distribution
Contact with direct sunlight must be avoided throughout the distribution channel

13.10 Validation

a) Once the hygiene is implemented and the processing guideline is in compliance with the requirements of the standard, the microbiological tests are to be conducted.

b) Carry out the quality parameters and record the results

14.0 Hazard Analysis Critical Control Point (HACCP) Exercise

The following process steps have been identified as the Critical Control Points (CCPs) in the processing of Pandanus juice.

a) Reception and collection of raw materials; overripe, damaged, moldy and infested produce will affect product quality and safety.

b) Pasteurization; pathogens is hazardous to consumers.

c) Sterilization; micro organisms and bacterial spores will affect safety and quality of products.

d) Glass filling because of glass breakages

14.1. HACCP for Pandanus Juice.

14.1.1 Hazard are classified into

i) Physical - foreign materials that may have contaminated the product e.g metals, glass, nuts and bolts

ii) Chemical - pesticides, insecticides, some chemical additives that may cause to consumers

iii) Microbiological - pathogenic bacteria and bacterial spores

14.1.2 Safety Checks

The following tests are to be conducted after implementing the hygiene and processing guide.

a) Microbiological analysis (specification for any fruit juice according to CODEX standard)

b) Records of Pasteurization

c) Raw material rejection documents

d) Records of Non conformance
### Table 4: Summary of HACCP for Pandanus Juice

<table>
<thead>
<tr>
<th>Step</th>
<th>Reason for CCP</th>
<th>Critical limit</th>
<th>Correction</th>
<th>Corrective Action</th>
<th>Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception of fruits</td>
<td>Mycotoxins</td>
<td>No bruised &amp; overripe fruits No infestation of moulds</td>
<td>Recheck the fruits Rejection of fruits</td>
<td>Reinforce awareness Training program Monitor losses closely Ensure 100%</td>
<td>Material losses</td>
</tr>
<tr>
<td>Processing</td>
<td>Coli forms</td>
<td>Pasteurization at 85 deg C for 5mins (PET bottle packaging)</td>
<td>Put on hold and re pasteurize</td>
<td>Identify root causes of problems and prevent occurrence</td>
<td>Pasteurization records</td>
</tr>
<tr>
<td></td>
<td>Bacterial spores</td>
<td>Pre pasteurize at 85 Deg for 5 sec. then sterilize for 30mins over hot water bath</td>
<td>Put on Hold and re sterilize</td>
<td></td>
<td>Sterilization records</td>
</tr>
<tr>
<td>Glass filling</td>
<td>Glass breakages</td>
<td>No glass splinters</td>
<td>Discard empty and filled bottles within safe limit</td>
<td>Identify root cause of problems and prevent occurrence</td>
<td>Non conformance reports</td>
</tr>
</tbody>
</table>

### 14.1.3 Quality Checks

The local counterpart or supervisor carries out the following in house checks for the juice Brix, pH, Color, Texture and Taste

**a) Brix**

**Definition:** Degree Brix (symbol ° Bx) is a measurement of the mass ratio of dissolved sucrose to water in a liquid. In this exercise it is measured with a refractometer. A 25 ° Brix solution has 25g of sucrose per 100g of liquid OR there are 25 g of sucrose sugar and 75 g of water in the 100g of solution.
b) pH

**Definition:** Is a measure of the activity of hydrogen ions (H⁺) in a solution and therefore its acidity or alkalinity. An aqueous solution with a pH values lower than 7 are considered acidic, while pH values higher than 7 are considered alkaline. *(An aqueous solution is a solution in which the solvent is water)*

**Example:**

<table>
<thead>
<tr>
<th>Product</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon Juice</td>
<td>2.4</td>
</tr>
<tr>
<td>Vinegar</td>
<td>2.9</td>
</tr>
<tr>
<td>Orange Juice</td>
<td>3.5</td>
</tr>
<tr>
<td>Beer</td>
<td>4.5</td>
</tr>
<tr>
<td>Tea</td>
<td>5.5</td>
</tr>
<tr>
<td>Milk</td>
<td>6.5</td>
</tr>
<tr>
<td>Pure Water</td>
<td>7.0</td>
</tr>
<tr>
<td>Sea water</td>
<td>8.0</td>
</tr>
<tr>
<td>Hand soap</td>
<td>9.0-10.0</td>
</tr>
</tbody>
</table>

**c) Color**

The color is a unique feature and quality of the fruit or produce. It is the original characteristic of a fruit, indication of freshness, distinguishes the varieties, indication of the standard of processing procedures implemented, overcooking may show dark coloration.

The manufacturer must establish a standard color code for comparison.

**Taste**

The juice of freshly produced before release for sale and reference sample juice throughout shelf life is tasted.

a) Identify acid taste or any off flavors
b) Check for guarantee of shelf life

Juice is to be tested for taste and results to be recorded.

15.0 Consumer Assessment

The consumer assessment for any product developed is carried out using the Hedonic scale (Appendix 2) to establish product quality and or consumer acceptance of the formula.

a) Different formulations of one particular product is tested to identify which formula is more acceptable by the consumer
b) For comparison of developed products against similar commercial products to test level of acceptance and comparability.

Analyzing the consumer assessment will indicate acceptance or non acceptance, comparability or otherwise with similar type of products.
These results will enable one to make proper decision on the next steps to be followed for product developed.

16.0 Recommendation

It is recommended that the factory plant be separated from the main office building to avoid insect infestation.

The management is requested to separate the collection and storage area of the Pandanus from the processing area as the current practice brings in a lot of flies during the processing.

There is a need for an insectocutor in the plant to capture insects.

The workers must adhere to the practices of weighing raw materials and outputs as well as blanching the fruits pieces before processing and pasteurizing the juice before packing to ensure products is safe for consumption.

The management must provide proper working outfit and attire for the workers during processing.

Proper hygienic practices is emphasized as process is half manual and mechanical.

17.0 Acknowledgement

I would like to thank the Secretariat of the Pacific Community in Fiji, in particular Dr LEx Thomson, Head of FACT, SPC for the funding of this project. I also thank Mr Ramsey Reimers, Ms Tema Koto of RRE, Mr Manasa Katoivualiku of SPC and the Director IAS, Prof Bill Aalbersberg for the support provided in carrying out the project and the following factory staff for their patience and willingness to learn during the process: Anson Harris, Ms Valerie Reimers, Tata Lometo, Gin Alas, Morson Reuben, Tolwi Doctor and Stromel Tsitsi.

18.0 References:


19.0 Appendices
Appendix 1: Terms of References for the Consultancy
"FORMULATION OF A BUSINESS AND MARKETING PLAN
FOR ROBERT REIMER ENTERPRISES INC PANDANUS FOODS"

This consultancy will be conducted under the terms and conditions specified in this contract.

1. DURATION
The duration of this consultancy is 35 days including travel (with up to four weeks to be spent in Marshall Islands). Consultancy will commence in first week of January 2009.

2.0 TERMS OF REFERENCE (see full TOR annexed)
The Consultant will;

2.1 In consultation with FACT Project Team Leader (Dr Lex Thomson), FACT Agricultural Production Technician (Mr Manasa Katonivaliku) and Robert Reimer Enterprises Inc (Mr Ramsey Reimers) formulate a business and marketing plan for the Robert Reimer Enterprises Inc’s Pandanus food company and, in doing so, is expected to undertake the following:

- Provide on-site training to RRE staff in production of Pandanus juice and baby food, especially in relation to food safety and product quality;
- Suggest any promising new Pandanus food products and provide advice on production techniques, equipment needs and packaging/labelling;
- Advice on nutrient analyses to be undertaken on RRE Pandanus food products;
- Participate in one-day Pandanus festival (10 January 2009), including acting as resource person at RRE stand.
• Assist in identification of niche markets for Pandanus food products locally and overseas;
• Develop marketing strategy for RRE Pandanus food products;
• Provide a full report on all activities covered under the TOR, including well guided recommendations on how to develop the business into a more viable commercial operation.

2.2 Within three weeks of the completion of the assessment, prepare a draft report on the assignment and submit to the FACT Project Team Leader, in electronic version, for comments.

2.3 Prepare a final report on the assignment, incorporating relevant comments received, and submit to the FACT Project Team Leader within three weeks of the receipt of comments (comments to be received two weeks after the draft report is received). Photographs and diagrams should be used wherever possible.

3.0 REPORTING REQUIREMENTS

The consultant will report to the Director Land Resources Division. The consultant will work in close consultation FACT Project Team Leader (Dr Lex Thomson), FACT Agricultural Production Technician (Mr Manasa Katonivualiku) and Robert Reimer Enterprises Inc (Mr Ramsey Reimers). The consultant will write and submit a draft report within three weeks of completion of the assignment and prepare a final report on the assignment, incorporating relevant comments received from the countries and other agencies concerned, and submit to the SPC Forests and Trees Programme within three weeks of the deadline for comments as specified in section 2.3 above. This report should be provided in a camera-ready, A-4 format electronically. Photographs and diagrams should be used wherever possible.

4.0 TRAVEL
The Secretariat of the Pacific Community agrees to provide the following:

4.1 Return air fares by the most direct and economical route;
4.2 Per-diem at official SPC rates based on the agreed itinerary;
4.3 Reimbursement of other approved costs on submission of prior approved claims and receipts, boarding passes, and ticket stubs.

5.0 VISA REQUIREMENTS
It is the responsibility of the consultant to arrange for his own visas. SPC can assist in determining the visas required. This contract can be used to support your visa application.

6.0 CONSULTANCY FEES
Fee for this consultancy will be at a lump sum rate of USD 7,000. No other fees form part of this agreement. This fee covers any tax liability in relation to the consultancy fee.

7.0 PAYMENT SCHEDULE
Payments will be made on submission of invoice by the consultant as follows:

7.1 The first instalment of USD 3,350 on travel to Marshall Islands.
7.2 The second instalment of USD 2,300 to be paid upon completion of duties 2.1 and 2.2 specified above;
7.3 The final instalment of the USD 1,150 upon acceptance by SPC of the final report;
7.4 Per-diem at official SPC rates in advance on completion of travel arrangements;
7.5 Air-tickets will be organised by SPC with PTA submitted to the consultant before travel dates;
7.6 All other prior approved costs only on submission of invoices and receipts, used ticket stubs and boarding passes, upon completion of the travel.

All payments will be deposited at the following nominated bank account.

Bank : Westpac Banking Corporation

Account Name : IAS/ USP

Account No. 9801283301

8.0 PENALTY A penalty of USD50.00 per day will be deductible from the consultancy fee for every day the report is delayed by the consultant, unless prior written arrangement is made with the Director Land Resources Division.

9.0 INSURANCE
The Secretariat of the Pacific Community does not insure or compensate consultants against illness, injury, other disability or loss of life during the terms of their consultancies.

10. COMMUNICATION OF UNPUBLISHED INFORMATION
It is a condition of appointment to the Secretariat of the Pacific Community that you shall not communicate to any person or to the press any unpublished information known to you by reason of your official position except in the course of duty or by authorisation of the Director General.

11. COPYRIGHT
All written and printed materials and copyright to the materials produced under this contract are the property of the Secretariat of the Pacific Community. The author’s name will appear on all original materials written by him in fulfilment of this contract.

12. BIOSECURITY and SOVEREIGNTY
The consultant should fully comply with all Biosecurity Arrangements, Laws and Sovereign rights of the countries to be visited during the tenure of this contract, including declarations to authorities and SPC that biological material will be collected and exported from or imported to countries visited or en-route or to fulfil conditions of this contract.

13. OTHER CONDITIONS
There are no benefits attached to this consultancy other than those specified above. The Terms of Reference of this consultancy may be amended or added to by mutual agreement between the Consultant and the Director General.

If you accept this consultancy under the terms and conditions specified, please sign this letter below and return it to the Divisional Administrative Officer, on fax +679- 3386326.

Yours sincerely

Aleki Sisifa
Acting Deputy Director General
Suva Operations
The Acting Deputy Director General – Suva Operations

Secretariat of the Pacific Community

Private Mail Bag, Suva

Fiji

Dear Sir

I hereby accept the terms and conditions of this consultancy as specified above.

Ms Api Cegumalua

Institute of Applied Science

Facility of Science and Technology

University of the South Pacific, Suva Fiji

Appendix 2 : Hedonic Scale Form
**Hedonic Scale**

**Product**: Drink Samples

**Date**: ..........................

**Instructions:**
Please taste the drinks coded A, B, C, D, E
Then place the sample drink code beside the words that best describe your opinion of the sample.

<table>
<thead>
<tr>
<th>Very acceptable</th>
<th>........................</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately acceptable</td>
<td>........................</td>
</tr>
<tr>
<td>Slightly acceptable</td>
<td>........................</td>
</tr>
<tr>
<td>Neither acceptable nor unacceptable</td>
<td>..................</td>
</tr>
<tr>
<td>Slightly unacceptable</td>
<td>........................</td>
</tr>
<tr>
<td>Moderately unacceptable</td>
<td>........................</td>
</tr>
<tr>
<td>Very unacceptable</td>
<td>........................</td>
</tr>
</tbody>
</table>

**Why did you rate the product this way?**

A

B

C

D

E

Thank you for your help!