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## Investigation of different factors affecting to papaya-coconut milk confectionery processing

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### Abstract

Papaya and coconut have various nutritional ingredients for human health. Ripe papaya fruit is most commonly consumed like a melon. It can be peeled, the seeds removed, cut into pieces and served as a fresh fruit. It can also be cut into wedges and then served with lime or lemon. Ripe pawpaw is also used in confectionery, jelly, marmalade and other products containing added sugar. Other processed products include puree or wine, nectar juice, frozen slices or chunks, mixed beverages, papaya powder, baby food, concentrated and candied items. Coconut milk is an emulsion which is stabilized by naturally occurring proteins. Our research is to investigate different technical factors affecting to the combination of papaya pulp and coconut milk in confectionery processing. Results are as follows: sugar 60%, pectin 1%, citric acid 0.3%, coconut milk 9%, papaya flavour 0.04%. Product should be kept in dry clean normal temperature.

**Keywords:** Papaya pulp, coconut milk, technical factor, combination, confectionery

### 1. Introduction

Papaya (*Carica papaya* L.) belongs to the family *Caricaceae*, one of the most important fruits cultivated throughout the tropical and subtropical regions of the world. Papaya (*Carica papaya* L.) is regarded as an excellent source of ascorbic acid, a good source of carotene, riboflavin and a fair source of iron, calcium, thiamin, niacin, pantothenic acid, vitamin B-6 and vitamin K. Each and every part of papaya plant from root to shoot is used for medicament purposes. Ripe papaya fruit is used in confectionery, jelly, marmalade, puree, wine, nectar, juice, frozen slices, mixed beverages, ice-cream, powder, baby food, cooked in pie, pickled, sweet meat, concentrated and candied items (P. L. Saran et al., 2013).

Coconut milk is the natural oil-in-water emulsion extracted from the endosperm of mature coconut (*Cocos nucifera* L.) (Seow and Gwee, 1997; Nattapol Tangsuphoom et al. 2009; S.N. Raghavendra et al., 2010) and it plays an important role in many traditional foods of Asian and Pacific regions (Chiewchan et al., 2006). Coconut milk contains about 54% moisture, 35% fat and 11% solid non-fat (Simuang et al., 2004; Tansakul and Chaisawang, 2006). Freshly extracted coconut milk is a stable emulsion, which requires extra energy to destabilize this emulsion (McGlone et al., 1986). It is naturally stabilized by coconut proteins such as globulins and albumins as well as phospholipids (Tangsuphoom and Coupland, 2008). Some of the proteins present in the aqueous phase of the coconut milk interact with fat globules and act as emulsifier by surrounding its surface (Peamprasart and Chiewchan, 2006).



**Fig 1:** Papaya and coconut

Purpose of our research is to combine papaya pulp and coconut milk together to produce a papaya-coconut milk confectionery.

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During this combination, we investigate different factors affecting to confectionery quality such as coconut milk extraction temperature, coconut milk ratio, additive (sugar, citric acid, pectin, papaya flavour) supplementation, and pasteurization temperature.

## 2. Material & Method

### 2.1 Material

Main materials include papaya fruit and coconut milk juice. Moreover, we also use some other materials such as sugar, pectin, ascorbic acid, vanilla, etc. All of them are originated in Tra Vinh province.

### 2.2 Research method

#### 2.2.1 Raw material determination

Weight percentage: papaya fruit, coconut

Chemical percentage: Papaya: Dry matter, citric acid, sugar;

Coconut milk: Lipid, mineral

#### 2.2.2 Different factors affecting to papaya-coconut milk confectionery

##### 2.2.2.1 Determine temperature to extract coconut milk

Examine different extraction temperatures: 85 °C, 90 °C, 95 °C, 100 °C, 105 °C to select the best temperature for coconut milk juice extraction.

##### 2.2.2.2 Determine ratio of coconut milk supplementation into papaya-coconut milk confectionery

Examine different coconut milk ratios supplemented into confectionery: 5%, 7%, 9%, 11%, 13%.

##### 2.2.2.3 Determine sugar supplementation to papaya-coconut milk confectionery

Examine different sugar ratios supplemented into confectionery: 45%, 50%, 55%, 60%, 65%.

##### 2.2.2.4 Determine citric acid supplementation to papaya-coconut milk confectionery

Examine different citric acid ratios supplemented into confectionery: 0.20%, 0.25%, 0.30%, 0.35%, 0.40%

##### 2.2.2.5 Determine pectin supplementation to papaya-coconut milk confectionery

Examine different pectin ratios supplemented into confectionery: 0.8%, 0.9%, 1.0%, 1.1%, 1.2%

##### 2.2.2.6 Determine papaya flavour supplementation to papaya-coconut milk confectionery

Examine different papaya flavour ratios supplemented into confectionery: 0.02%, 0.04%, 0.06%, 0.08%.

##### 2.2.2.7 Determine the maintaining pasteurization temperature

Examine different maintaining pasteurization temperatures (minutes): 20, 25, 30, 35.

### 2.3 Statistical analyses

Use Microsoft Excel 2003 at 95% confidence level.

## 3. Result & Discussion

### 3.1 Composition in raw materials

#### 3.1.1 Papaya

##### 3.1.1.1 Weight percentage

**Table 1:** Edible and unedible in papaya fruit

| Sample         | Weight (kg) | Edible weight (kg) | Inedible weight (kg) | Percentage of edible weight (%) |
|----------------|-------------|--------------------|----------------------|---------------------------------|
| 1              | 1.2         | 0.96               | 0.24                 | 80                              |
| 2              | 1.4         | 1.08               | 0.32                 | 77                              |
| 3              | 1.6         | 1.25               | 0.3                  | 78                              |
| <b>Average</b> |             |                    |                      | 78                              |

Edible part in papaya is 78% which is suitable for confectionery processing.

##### 3.1.1.2. Chemical composition

**Table 2:** Dry matter in papaya fruit

| Criteria       | Weight before drying (g) | Weight after drying (g) | Moisture (%) | Dry matter (%) |
|----------------|--------------------------|-------------------------|--------------|----------------|
| 1              | 31.96                    | 23.35                   | 71.83        | 28.18          |
| 2              | 28.60                    | 19.17                   | 73.25        | 26.75          |
| 3              | 28.85                    | 19.42                   | 72.48        | 27.52          |
| <b>Average</b> |                          |                         | 72.52        | 27.47          |

Average dry matter in papaya fruit is 27.47%, which is quite high so there is not necessary to concentrate before processing confectionery.

**Table 3:** Acidity in papaya fruit

| Sample         | Sample volume (ml) | Volume of NaOH 0.1 N for titration (ml) | Acidity (%) |
|----------------|--------------------|---|-------------|
| 1              | 20                 | 0.35                                    | 0.12        |
| 2              | 20                 | 0.37                                    | 0.18        |
| 3              | 20                 | 0.40                                    | 0.28        |
| <b>Average</b> |                    |   | 0.19        |

Average acidity in papaya fruit is 0.019% which is not enough for confectionery processing so it's necessary to add more acid agent.

**Table 4:** Sugar content in fruit

| Sample         | Volume of KMnO <sub>4</sub> 0.1N for titration (ml) | Reduced sugar (mg) | Reduced sugar (%) | Saccaroza (%) | Total sugar (%) |
|----------------|---|--------------------|-------------------|---------------|-----------------|
| 1              | 3.30  | 10.03              | 5.28              | 5.02          | 10.30           |
| 2              | 3.40  | 10.06              | 5.30              | 5.03          | 10.33           |
| 3              | 3.35  | 10.05              | 5.29              | 5.02          | 10.31           |
| <b>Average</b> |   | 10.047             | 5.29              | 5.02          | 10.31           |

Sugar content in papaya fruit is 10.31% which is not enough for confectionery processing so it's necessary to add more sugar.

### 3.1.2 Coconut milk

Lipid in coconut milk creates not only fatty taste

but also solvent for dissolving carotene in papaya pulp.

**Table 5:** Lipid content in coconut milk

| Sample         | Sample weight (g) | Lipid weight (g) | Lipid percentage (%) |
|----------------|-------------------|------------------|----------------------|
| 1              | 10.20             | 3.40             | 33.33                |
| 2              | 11.13             | 3.06             | 34.20                |
| 3              | 12.52             | 4.13             | 33.51                |
| <b>Average</b> |                   |                  | 33.68                |

Lipid content in coconut milk is very high so it's not necessary to add too much into confectionery processing.

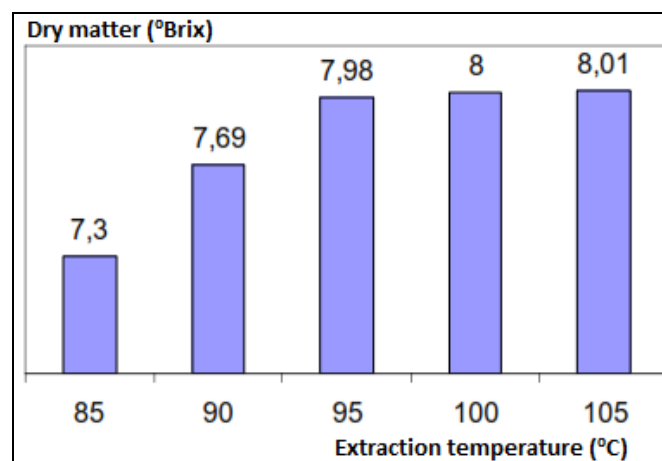
**Table 6:** Mineral in coconut milk

| Sample         | Sample weight (g) | Mineral (g) | Mineral (%) |
|----------------|-------------------|-------------|-------------|
| 1              | 10.12             | 0.886       | 8.75        |
| 2              | 12.27             | 1.119       | 9.12        |
| 3              | 13.53             | 1.128       | 8.34        |
| <b>Average</b> |                   |             | 8.74        |

Coconut milk supplementation into confectionery supplies not only nutrients but also mineral which is useful for human body.

## 3.2 Determine additives and technical parameters for confectionery processing

### 3.2.1 Temperature for coconut milk extraction

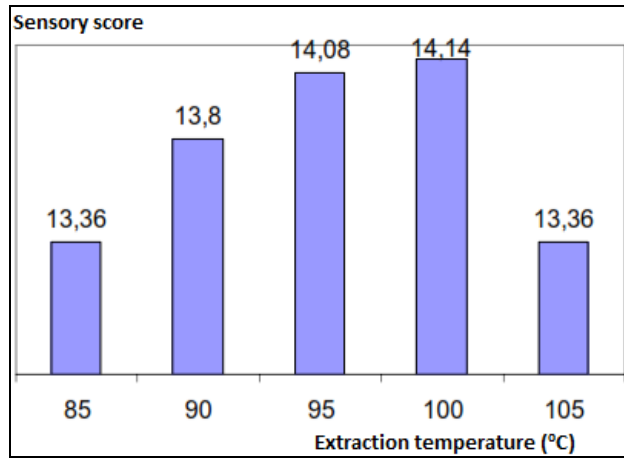
**Fig 2:** Dry matter in coconut milk by different extraction temperatures

When increasing extraction temperature 85-90 °C, dry matter in coconut milk increases 0.39 Bx. Meanwhile, in temperature range 95-105 °C dry matter in coconut milk is nearly the same. So 95 °C suitable for further experiments.

In low coconut milk percentage, papaya aroma is superior to coconut aroma. Taste in coconut milk is also inferior to sugar sweet so it's difficult to sense coconut milk. However if there is too much coconut milk, papaya aroma will be

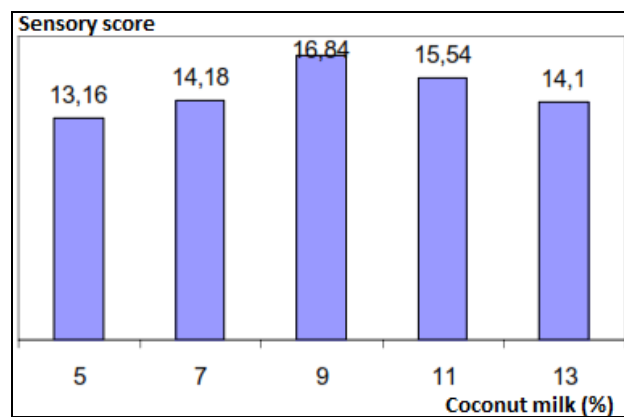
omitted. Moreover, fatty and sweet taste will subsequently create depression. From figure 4, coconut milk ratio 9% is appropriated for confectionery processing.

Coconut milk supplementation increase not only sensory value but also nutrients such as vitamin, protein, lipid and minerals (Na<sup>+</sup>, K<sup>+</sup>, Fe<sup>++</sup>...) to balance dielectrics and detoxication. Lipid in coconut milk help to dissolve β carotene which is evitable for human consumption



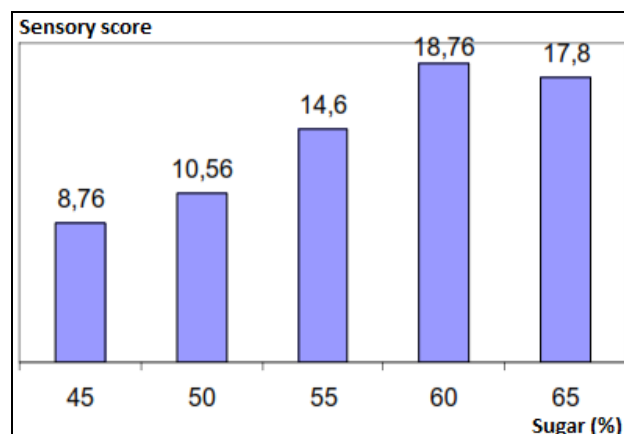
**Fig 3:** Sensory score of coconut milk by different extraction temperatures

**3.2.2 Determine the coconut milk ratio**



**Fig 4:** Sensory score in product supplemented coconut milk

**3.2.3 Determine sugar supplementation**

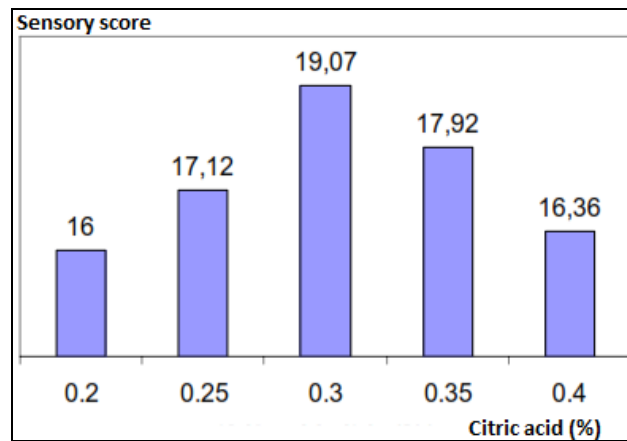


**Fig 5:** Sensory score of confectionery by different sugar concentration

At low sugar concentration, confectionery has light yellow color, strong papaya aroma, low sweet taste, less fine structure. At high sugar concentration, confectionery has

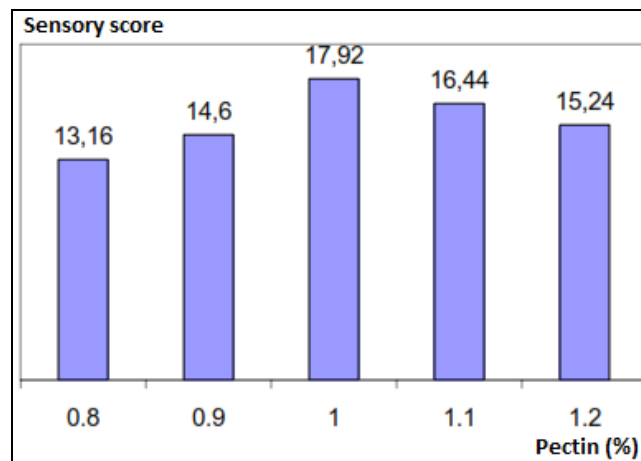
dark yellow color, burned aroma, strong sugar aroma, less fine structure. Sugar at 60% is appropriated for confectionery processing.

### 3.2.4 Determine citric acid supplementation



**Fig 6:** Sensory score of confectionery supplemented with citric acid  
At citric acid concentration 0.3% is suitable for confectionery processing.

### 3.2.5 Determine pectin ratio for confectionery processing

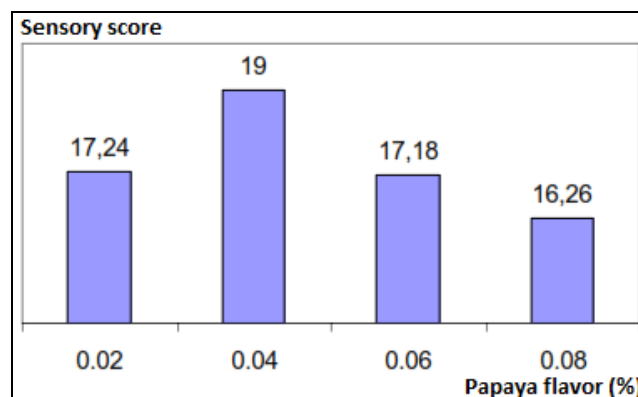


**Fig 7:** Sensory score for confectionery supplemented pectin  
Pectin 1% is appropriated for confectionery processing.

### 3.2.6 Determine papaya flavour supplementation into confectionery during processing

During processing, papaya flavour is escaped or destroyed so it's necessary to add more papaya

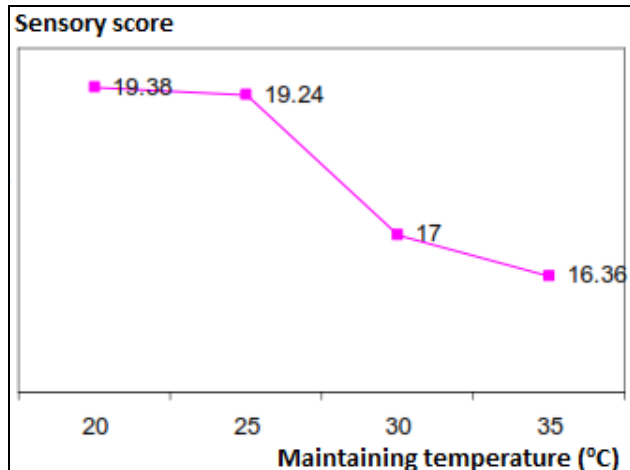
flavour to create a flavour balance.



**Fig 8:** Sensory score of confectionery supplemented papaya flavour  
Papaya flavour supplemented at 0.04% is adequate to get the highest confectionery quality.

### 3.2.7 Determine the maintaining time during pasteurization

Confectionery is pasteurized at 100 °C in glass jar. Raising temperature: 20 minutes, lowering temperature: 20 minutes, maintaining temperature: 20-30 minutes.



**Fig 9: Sensory score of confectionery by different maintaining temperatures**



**Fig 10: Papaya-coconut milk confectionery**

### 4. Conclusion

Papaya has always held an attraction for people. The ripe fruits are consumed as a fruit and as ingredient in confectionery, preserves in various ways. Fresh coconut milk has a consistency and mildly sweet taste similar to that of cow's milk, and if properly prepared, should have little or no coconut odour. A combination of these ingredients together will create a delicious confectionery. Finding optimal parameters for this confectionery manufacture is evitable.

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