

## CHAPTER 5

### CONCLUSIONS

The conclusions for the results of this research, which was the nutritional value, antioxidant content and antioxidant activity of noni fruit and juice affected by thermal processing, fermentation and storage temperature, were as followed:

1. The chemical composition and physical properties of three harvesting stages of fresh noni fruits, including unripen fruits (green noni fruit), half-ripen (light yellow noni fruit) and fully ripen (light brown fruit) were: fully ripen had higher amounts of moisture content ( $88.30 \pm 0.32\%$ ), fiber ( $1.60 \pm 0.02\%$ ), reducing sugar ( $4.45 \pm 0.01\%$ ) and total sugar ( $5.33 \pm 0.01\%$ ) than half-ripen and unripen fruits. Moisture, fiber, reducing sugar and total sugar were slightly increased during ripening. Fully ripen fruits had lower amounts of ash ( $0.39 \pm 0.01\%$ ) and carbohydrate ( $14.05 \pm 0.40\%$ ) than half-ripen and unripen fruits. Ash and carbohydrate content were slightly decreased during ripening. Titratable acidity as citric acid content declined slightly during ripening from  $0.98 \pm 0.01$  to  $0.37 \pm 0.02$  g/100g, whereas pH slightly increased from  $4.11 \pm 0.00$  to  $4.47 \pm 0.01$ .

2. Antioxidant content as followed: An increase in the ascorbic acid content was observed from unripen to half-ripen ( $97.4 \pm 1.47$  to  $110.0 \pm 3.05$  mg/100g). The content of ascorbic acid was the highest in the half-ripen stage, whereas then decreased to the lowest of fully ripen stage ( $69.8 \pm 2.18$  mg/100g). During noni ripening, the carotenoid content was declined. Unripen noni fruit have the highest content of carotenoid ( $18.30 \pm 0.56$   $\mu$ g/100g) then decrease in the half-ripen ( $15.58 \pm 0.30$   $\mu$ g/100g) and the lowest in fully ripen ( $3.96 \pm 0.58$   $\mu$ g/100g). The flavonoid content decreased during ripening from  $221.8 \pm 3.1$  to  $58.1 \pm 2.5$  mg/100g and the total phenolic content decreased from  $369.1 \pm 2.2$  to  $69.5 \pm 2.9$  mg/100g. Unripen fruit had the highest antioxidant activity whereas fully ripen had the lowest. The main antioxidant content of fresh noni juice comprised of ascorbic acid ( $87.8 \pm 1.64$  mg/100ml), carotenoid ( $13.32 \pm 0.20$   $\mu$ g/ml), flavonoid ( $175.1 \pm 16.2$  mg/100ml) and total phenolic ( $336.8 \pm 19.2$  mg/100ml). Noni juice had high antioxidant activity

which represent in  $IC_{50}$  as  $13.60 \pm 0.50$  mg/g DPPH. The optimum ripening stage to harvest noni fruits harvest based on carotenoid content, flavonoid content and total phenolic content was the unripen stage. If noni fruits are harvested in a half-ripen stage, they have considerably higher content of moisture, reducing sugar, total sugar and ascorbic acid.

3. Effect of thermal processing on antioxidant component as followed: the unprocessed raw juice had the highest ascorbic acid content ( $87.8 \pm 1.64$  mg/100ml). After pasteurization at  $88^{\circ}\text{C}$  for 16 seconds,  $71^{\circ}\text{C}$  for 1 minutes,  $63^{\circ}\text{C}$  for 30 minute and boiled at  $100^{\circ}\text{C}$  for 10 minute, ascorbic acid content decreased by 17.3%, 28.8%, 38.5%, and 78.5%, respectively compared with unprocessed raw juice. Carotenoid content decreased by 5.3%, 9.9%, 21.7% and 67.9%, respectively at the similar processing conditions. Pasteurization treatments did not affect the flavonoid content and total phenolic content of noni juices. Pasteurized noni juices retained their antioxidant activity despite the loss of ascorbic acid and carotenoid.

4. Effect of fermentation on antioxidant component as followed: both of ascorbic acid and carotenoid were slowly decreased during fermentation. 16% of ascorbic acid content was lost by 120 days fermentation, whereas 31% of carotenoid content was lost by 120 days fermentation. Significant increase of flavonoid and total phenolic content during fermentation was recorded. After 120 fermentation day, flavonoid content increased by 38% and total phenolic increased by 23%. Antioxidant activity of noni juices correlated with flavonoid and total phenolic content. This result suggest that the fermentation did a positive effect on the antioxidant activity.

5. Effect of storage temperature on antioxidant component as followed: both at  $4^{\circ}\text{C}$  and room temperature storage showed decreasing of ascorbic acid content by 30% and 57%, respectively. Both at  $4^{\circ}\text{C}$  and room temperature storage showed decreasing of carotenoid contents by 12% and 41%, respectively. Storage temperatures did not affect the flavonoid and total phenolic content of noni juices. Antioxidant activity correlated with the flavonoid and total phenolic contents. These compounds did not change during storage despite losses of ascorbic acid and carotenoid contents.

**Suggestion**

1. Identification of other antioxidant components of noni juices and determine their relationship with the antioxidant activity of noni juices.

2. Application of High Performance Liquid Chromatography or Gas Chromatography Mass Spectrophotometry to further identify and determine antioxidant compounds of noni juices.