

## CHAPTER 5

### CONCLUSION AND RECOMMENDATION

Microbiological and chemical properties of fresh noni fruit included  $5.52 \pm 0.005$  log CFU/ml TPC,  $5.00 \pm 0.05$  log CFU/ml yeasts and moulds,  $5.13 \pm 0.02$  log CFU/ml Gram negative bacteria,  $2.89 \pm 0.00$  log CFU/ml lactic acid bacteria, 75 MPN/ml coliform,  $3.64 \pm 0.02$  log CFU/ml proteolytic bacteria,  $4.05 \pm 0.01$  log CFU/ml *Bacillus* spp.,  $2.69 \pm 0.01$  log CFU/ml *Clostridium* spp.,  $0.95 \pm 0.01$  g/100 ml total acidity and a pH value of  $4.65 \pm 0.005$ .

A commercial fermented noni juice contained high numbers of TPC, yeasts and moulds, Gram negative bacteria and lactic acid bacteria. These microorganisms were significantly present at lower number in a commercial noni juices. Samples from both the commercial fermented noni juices and the commercial noni juices also showed that coliform, *Bacillus* spp. and *Clostridium* spp. were present at the minimum detection limits of the microbiological methods used to analyze these samples.

Microbiological composition of fermented noni juices demonstrated that the population of Gram negative bacteria, coliform, proteolytic bacteria, *Bacillus* spp. and *Clostridium* spp. were significantly reduced during the fermentation period reaching the minimum detection limits of the microbiological methods used to analyze the fermented noni samples. For yeasts and moulds, the microorganism population was also reduced during the fermentation period, but the final population on the 36 weeks of the fermentation time was still at a level of  $4.63 \pm 0.19$  log CFU/ml. TPC and lactic acid bacteria of the fermented noni juices were increased for 1.41 and 5.15 log CFU/ml, respectively, during the fermentation period of the product. The acidity of the fermented noni juices was also significantly increased during the incubation period reaching a total acidity of  $2.98 \pm 0.02$  g/100 ml and a pH value of  $3.53 \pm 0.01$  at the end of the fermentation period.

Applying different heat treatment conditions of 64°C for 15 min, 72°C for 1 min, 80°C for 15 s and 100°C for 10 min for fresh noni juices produced different microbial composition in the heat-treated noni juices directly after the heat treatments. All of the heat-treated noni juices contained < 3 MPN/g coliform bacteria. Heating the noni juices at 100°C for 10 min caused TPC, Gram negative bacteria, lactic acid bacteria and *Bacillus* spp. to be lower than those of the other heat treatment combinations. At the same time proteolytic bacteria was not being detected in the heat-treated noni juices processed at 100°C for 10 min.

Keeping heat-treated noni juices at 4°C for 21 days displayed that coliform bacteria was maintained at < 3 MPN/g throughout the storage period for all the heat-treated noni juice samples. For the other microorganism types, a low increase for up to 1 log CFU/ml was generally being detected in the heat-treated noni juices throughout the storage period. Total microbial populations of  $3.21 \pm 0.01$ ,  $2.69 \pm 0.04$ ,  $2.81 \pm 0.02$  and  $2.74 \pm 0.02$  log CFU/ml were found in the heat-treated noni juices processed at 64°C for 15 min, at 72°C for 1 min, at 80°C for 15 s and at 100°C for 10 min, respectively, at the end of the storage time.

Storing heat-treated noni juices at room temperature for 21 days showed that the higher storage temperature supported the growth of all microorganism types in the noni juice samples, including coliform. Total microbial populations of  $8.01 \pm 0.01$ ,  $8.42 \pm 0.02$ ,  $5.38 \pm 0.02$  and  $8.43 \pm 0.01$  were detected in the heat-treated noni juices processed at 64°C for 15 min, at 72°C for 1 min, at 80°C for 15 s and at 100°C for 10 min, respectively, at the end of the storage period. This finding clearly demonstrated the importance of low storage temperature for food products heated at temperatures of 100°C or below to extend the shelf life of the food products in the absence of other preservation methods.

The current market, basically centering on the Polynesian noni, and more specifically the Tahitian one, has conferred upon the fruit a unique and authentic appeal. Other countries may in the future decide to launch noni production and supplant the original producers. Market interest in this fruit suggests a bright future,

although more studies are needed to identify the nutritional and functional compounds it contains and explain their mechanisms of action in order to determine the real potential of this fruit and the technological processes that preserve these properties.

#### **Recommendations for the future research**

1. Besides microbial composition, chemical analysis should also be conducted in the future experiments to give a better explanation for the changing in the microbial composition in noni juices after heat treatments and during storage.
2. Other pasteurization conditions should be investigated to give a better understanding for the microbial composition of heat-treated noni juices and a possibility to keep more of beneficial noni juice properties.