CHAPTER 5

Conclusion

The overall conclusion for the study results could be presented as follows:

1. Papaya ripening stages and fruit dimensions significantly affected physicochemical properties and impregnation parameters of vacuum impregnated papaya ($p<0.05$). Unripe papaya samples significantly had the highest firmness compared to those of half and fully ripe papaya samples. Based on impregnation parameters, fully ripe papaya samples with a size of 1 x 1 x 1 cm^3 had the lowest water loss and ε_r value with high solid gain and ε_e value.

2. Impregnation solution ratio, vacuum time and relaxation time did not influence the physicochemical characteristics of vacuum impregnated papaya. However, the impregnation solution ratio and vacuum impregnation periods were important factors affecting permeation of external solution into papaya tissues. Higher impregnation of external solution was occurred at longer processing time. The highest solid gain, X value, γ value and effective porosity (ε_e value) together with the lowest water loss was determined in the papaya samples treated with 1:10 impregnation solution and processed for 10 min impregnation time and 30 min relaxation time.

3. Drying methods and temperatures significantly affected the physicochemical characteristics of partially dried papaya ($p<0.05$). Drying times of hot air drying were shorter than those of vacuum drying in drying temperatures between 40 and 60ºC. Higher drying temperatures reduced drying times. The highest vitamin C retention was determined in the papaya samples processed at 50ºC using both drying methods, while the highest yield was found in the samples dried at 60ºC. Applying the hot air drying could maintain more vitamin C and sample shape (less shrinkage) than that of vacuum

drying. The papaya samples processed by hot air drying also received higher sensory scores than those treated by vacuum drying.

4. Types of calcium solutions and impregnation temperatures significantly affected the physical properties of intermediate moisture papaya ($p<0.05$). The calcium solution played an important role on texture of the papaya samples. Higher calcium concentrations and impregnation temperatures significantly produced higher firmness values of the partially dried papaya. Calcium chloride could increase more papaya firmness than that of calcium lactate. On the other hand, applying calcium lactate reduced shrinkage of papaya samples compared to that added with calcium chloride. Based on a sensory analysis, panellists had a higher preference for papaya sample without calcium lactate for sensory attributes of flavour, texture and overall acceptance.

5. A vacuum impregnation process could penetrate *L. casei* into papaya fruit tissue. A combination of vacuum impregnation and hot air drying produced a partially dried papaya product containing 6.09 log cfu/g lactic acid bacteria. Scanning electron micrographs of partially dried papaya samples confirmed that *L. casei* cells were present in the intercellular spaces of the papaya tissue.

6. The survival of lactic acid bacteria during storage in partially dried papaya was depended on storage times and temperatures. Keeping the partially dried papaya at low temperature had a better viability for lactic acid bacteria than that at room temperature. The viability of lactic acid bacteria was decreased throughout the storage time. At room temperature, a high number of lactic acid bacteria could only be maintained for a week period. Although the viability of lactic acid bacteria gradually reduced at 4 and −18ºC in the 1st month of storage, the survival of the microorganisms was better at the lower storage temperature. After 12 weeks of storage at 4 and −18ºC, the number of lactic acid bacteria was still higher than 7.0 log cfu/g. This indicated that the intermediate moisture papaya impregnated with *L. casei* could be stored up to 12 weeks at low storage temperatures of 4 and −18ºC. Total acidity and firmness values of papaya samples were slightly decreased throughout the storage time. Keeping the partially dried papaya at −18ºC could retain vitamin C more than those of the samples stored at other storage

temperatures. Lightness values tended to increase throughout the storage time, while a* and b* values were decreased.