CHAPTER 5

CONCLUSIONS

Chitosan showed a great inhibitory effect on the growth of most food spoilage bacteria tested including *M. luteus*, *B. cereus*, *En. aerogenes* and *E. coli*. The lowest concentration of chitosan to completely inhibit these organisms varied widely from 0.04 to 0.06% (w/v). Whereas, growth of the other bacteria strains, including *L. plantarum*, *Ps. fluorescens* and *S. marcescen* had been less affected by chitosan of 150,000 and 400,000 Da at a concentration as high as 0.08% (w/v). The molecular weight (150,000 Da) of chitosans had a significant effect on the compound ability to inhibit the growth of *En. aerogenes* and *E. coli* at concentrations of 0.02% and 0.04% (w/v) but not with other organisms tested. Therefore, differences in the antimicrobial activity of chitosan are dependent on the type of bacteria strain, and for some strains, specific characteristics of chitosan need to be considered.

From the study about the effect of pH on the antibacterial activity of chitosan, we concluded that pH had an effect on the chitosan antibacterial activity. This effect can be decreased at a certain acidic pH. At pH 4.5, chitosan showed the highest antibacterial activity for both *M. luteus* and *B. cereus*. The pH could also be used as a combination factor to increase the antibacterial activity of chitosan.

The effect of temperature on the antibacterial activity of chitosan can not be concluded in this study and required a further study with a wider range of growth temperatures tested.

In a mixed culture, chitosan had a greater antibacterial effect against *M. luteus* than *B. cereus* after 24 hr incubation. The cell number of *B. cereus* in a mixed culture showed a greater decrease compared to the first experiment as a single culture, which might be due to the toxicity effect of other compounds or by-products from *M. luteus* that present in the culture.

The amount of cell population had also an effect on the antimicrobial activity of chitosan. This activity was limited at higher microbial population. Chitosan showed an antibacterial activity when microbial populations were not more than 9.1×10^9 and 6.2×10^8 cells/ml for *M. luteus* and *B. cereus*, respectively. This data is very useful as information before applying chitosan in food. The level of initial microbial contaminants is an important factor before using chitosan as a natural preservative.

In the last experiment, the antimicrobial activity of chitosan in minced pork had a different effect on different types of microorganisms naturally present in meat. The viable cell counts of microorganisms in minced pork decreased significantly when chitosan was present. The antimicrobial properties of chitosan in liquid medium may not be the same as in complex food systems where an interaction of chitosan with other components may modulate its activity. The constituents of the food matrix appear to be an important effect on the antimicrobial efficacy of chitosan. In conclusion, an application of chitosan as a natural food preservative can be achieved when texture, flavor, color and appearance of the applied food have been further investigated.