CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Without addition of toxic chemicals, silk waste could be hydrolyzed in subcritical water for production of protein and amino acids. The conversion of silk waste increased with the temperature and time for hydrolysis, and the complete decomposition was found within 30 min at 200 °C.

5.1.2 The protein yield in sericin solution decreased with temperature and hydrolysis time, while the amino acid yield increased with increasing temperature and hydrolysis time.

5.1.3 The protein and amino acids yields of fibroin increased as temperature and hydrolysis time increased.

5.1.4 The most suitable condition for protein and amino acids production from sericin by subcritical water hydrolysis were 1:100 at 120 °C (0.466 mg protein/mg raw silk) and 1:20 at 160 °C (0.203 mg amino acids /mg raw silk), respectively.

5.1.5 The most suitable condition for protein and amino acids production from fibroin by subcritical water hydrolysis were 1:100 at 220 °C (0.455 mg protein/mg silk fibre) and 1:50 at 220 °C (0.755mg amino acids /mg silk fibre), respectively.

5.1.6 Hydrolysis reaction profiles of fibroin conversion in subcritical water suggested that overall reaction mechanism was influenced by surface reaction.

5.1.7 The sericin and fibroin microparticles obtained by freeze drying the soluble products at -40 °C was found to have a random coil/α-helix conformation and are of amorphous form based on the XRD, FTIR, and DSC results. This indicated the change in the conformation after the hydrolysis reaction. However, the structure of the particles could be affected by methods of drying, which should be studied further.

5.2 Recommendations

5.2.1. Although the method involves no addition of toxic chemicals, toxic compound could potentially be produced in a reaction at such high temperature. Therefore, the composition of the product should be analyzed to determine potential existence of other toxic chemicals produced. Moreover, the profile of different amino acids contained in the product could be determined using high performance liquid chromatography (See Appendix C).

5.2.2. Based on the surface reaction kinetics, the effect of preparation methods of the silk waste such that to maximize the surface area should be investigated to enhance the rate of reaction.

5.2.3. In the present work, the quantification of the kinetics of silk fibroin decomposition was performed and the kinetic parameters were determined for such reaction. Other reaction kinetics involving the decomposition of silk sericin and the production of protein and amino acids that describe the complete process would be useful for the process scale-up. Further experiments should be conducted to determine the kinetics of these reactions.

5.2.4. Different processes for the preparation of sericin and fibroin microparticles from the soluble products could have a great effect on the characteristics of the particle. These should be investigated.