

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Bacterial cellulose–gelatin (BCG) composite films were developed by two different methods, biosynthesis and impregnation. The incorporation of gelatin into the BCG films by the two methods improved the optical transparency of the films. The SEM images indicated that the mean fiber diameters of the BC, Biosyn-BCG and Impreg-BCG fibrils were in the similar range, however, the denser structure from gel filling in the voids between BC fibrils was observed in the modified films of Biosyn-BCG7 and Biosyn-BCG10. The FTIR result demonstrated the changes of peaks in Biosyn-BCG films, which implied the intermolecular interacting by hydrogen bond between the OH group of BC and gelatin. On the other hand, minor changes of peaks of the Impreg-BCG films indicated weak interactions between the -OH group of BC and gelatin. It was shown that the incorporation of gelatin into the films could reduce the tensile strength and elongation at break of the films. It was also illustrated that while the incorporation of gelatin by means of biosynthesis enhanced the WAC and caused the reduction in crystallinity index of the films, the minor changes in WAC and crystallinity index of the films were made by the gelatin impregnation. Nonetheless, the incorporation of gelatin into the films by the two methods had no considerably impact on oxygen and water vapor transmission rates. Finally, it was shown that the cross-linking by tannic acid exhibited the strong antibacterial action

against *Staphylococcus aureus* and the modified BC films do not present toxicity against Vero cells.

6.2 Recommendations for Future Studies.

Based on this study, further works for the improvement of bacterial cellulose film are recommended.

1. The study of the methodology to improve pore structure of BC-gelatin films for achieving an optimal oxygen and water vapor transmission rate.
2. The modification of bacterial cellulose by the incorporation of the herbal extracts such as the extract of mangosteen husk, Tiger herbal, Phlai or Tanaka.