CHAPTER V

CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

The poly(AM-*co*-IA) copolymer and poly(AM-*co*-IA)/mica nanocomposites were sucessfully prepared by solution polymerization. Acrylamide (AM) and itaconic acid (IA) were used as a comonomer pair. Mica was used as an inorganic additive component in the polymerization process which was found to increase the swollen gel strength. They were polymerized using APS and TEMED as a redox initiator pair and N-MBA as a crosslinking agent at the reaction temperature of 40-60 °C for 30 min. The determination of the residual amounts of acrylamide monomer in the polymer suggests that the solution polymerization is an acceptable synthesis route to prepare the superabsorbent polymer and superabsorbent polymer nanocomposites since the the residual amount of the acrylamide monomer is very minute (55-94 ppm). The effects of itaconic acid concentration, mica content, crosslinker concentration, reaction temperature were investigated. The water absorbency and the artificial urine absorbency can be achieved at the highest as 748±5 g g^{-1} and 76±2 g g^{-1}, respectively, while the neat copolymer (without mica) could give only 640±7 (in water) and 72±2 (in artificial urine) g g^{-1}, respectively. Such composites were obtained from the polymerization condition of AM/IA ratio of 95/5, 5% wt of mica, 0.2% mole of N-MBA, 0.3% mole of APS and a reaction temperature of 50±2 °C. However, the absorption rate of the nanocomposites can slightly decrease with increasing mica content.

During the mica dispersion, the monomer intercalated into the mica in a molecular scale. The XRD analysis of the composites indicates that the interlayer spacing of mica was increased from 12.44 to 13.95 Å (at 5%wt mica). These results suggest that the nanocomposites be successfully achieved since the mica can reinforce the polymer composites in the nanometer scale. The FTIR characterization of the poly(AM-*co*-IA)/mica nanocomposites gives the characteristic absorption peaks of the $-COO^-$ from the carboxylic acid group in the IA moiety at 1665-1664 cm^{-1} and the absorption peaks of Si-OH group in mica at 1016-1011 cm^{-1} and 473-471 cm^{-1}. The small amount of mica addition (5% wt) can effectively reinforce the gel strength of the superabsorbent composite. It was verified by the viscoelastic behavior and absorbency under load, in which the swollen gel of poly(AM-*co*-IA)/mica nanocomposites exhibits the mechanical rigidity. The thermogravimetric analysis can further support that the synthesized nanocomposites can be achieved with physical property enhancement, evidenced from the increment of the thermal stability.

The absorbency of the polymer reached its maximum value when the reaction temperature and crossinker concentration were 50°C and 0.2% mole. Since APS in the presence of TEMED has the dissociation efficiency in the lower reaction temperature of polymerization. The reasonable chemical crosslink density does not decrease the absorbency of the crosslinked polymer.

Lastly, the only 5% mica addition does not increase the density of superabsorbent. Such an addition has a trivial effect on the total weight of superabsorbent, and also provides the highest water absorbency. In summary, the synthesized poly(AM-*co*-IA)/mica nanocomposites gives adequate water absorption, in which the mica addition does not add the extra weight to the superabsorbent.

Therefore, the synthesized poly(AM-*co*-IA)/mica nanocomposites is a candidate for personal care applications.

5.2 Suggestions for Future Work

In the present research, several important points have not yet been investigated, such as the best ratios between APS and TEMED; IA and N-MBA on $\overline{M}_c$, G', G'' and water absorption. The synergistic effect of the co-initiator TEMED on dissociation of APS is worthwhile investigating. Salt solution effect on water absorption of these polymers and nanocomposites should be studied to observe some hidden interactions. Finally, waste management of the superabsorbent polymers and polymer nanocomposites and possible reused in soil erosion protection should be considered.