CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Na-bentonite was treated with quaternary alkyl ammonium cation, DOEM by ion exchange reaction. The organomodified bentonite was characterized by using XRD and FT-IR. The d-spacing of organomodified bentonite increases after treated with DOEM surfactant and the C=O bond and $-CH_2$ of surfactant occurred at 1740 and 2930 cm^{-1}.This result indicates that DOEM is incorporated in the bentonite, ensuring that organomodified bentonite is obtained. Both of Na-bentonite and organomodified bentonite which is treated with DOEM surfactant can show the ability to adsorb ethylene gas.

When the organomodified bentonite is mixed with PP to fabricate the active packaging film by varying the content of organomodified bentonite in the film and intercalation is occurred. The degradation temperature increases by increasing the clay contents but melting temperature and crystallization temperature decreases. In addition, the organomodified bentonite can improve the Young's modulus of the films when increasing the organomodified bentonite content but tensile strength and elongation at break decrease. When the organomodified bentonite content in the packaging film increases, the agglomeration occurs as shown in the SEM images. These agglomerations drop the tensile properties of the films. The ethylene gas permeability reduces when increasing the organomodified bentonite content. These results indicated that PP/organomodified bentonite nanocomposite film can be used as ethylene scavenger active packaging film to extend the self life of fresh fruits and vegetables.

Aluminium compounds which are aluminium hydroxide and aluminium acetate are used as ethylene scavengers. The aluminium compounds were mixed at 5, 10 and 15 % wt of 3% organomodified bentonite of nanocomposites to prepare ethylene scavenger active packaging films. The addition of aluminium compound into PP reduced % crystallinity, melting temperature and crystallization temperature of PP. These are the result from the disturbance of organomodified bentonite and

ethylene scavenger during crystalline formation process. However the crystal structure of PP was not affected by the existence of organomodified bentonite. Young's modulus, tensile strength and elongation at break of the active packaging films were reduced when compare with PP. When increase the content of aluminium compounds Young's modulus and tensile strength increased but elongation at break reduced. These due to the agglomeration of organomodified bentonite and aluminium compoumds. The ethylene permeability decreases when increasing the content of aluminium compounds.

6.2 Recommendations

Base on what have been discovered in this study, the following recommendations are suggested.

(1) Na-bentonite should be purified before organomodification to remove some impurity and obtain the colorless nanocomposites.

(2) Further studies on the processing conditions such as speed of twin screw extruder should be studied to determine the affect on dispersion of organomodified bentonite on PP.

(3) The other compatibilizers should be studied to improve the compatible of PP, organomodified bentonite and aluminium compounds.

(4) The study on effect of active packaging with various types of fresh fruits and vegetables should be focus.

(5) The emission of aluminium compounds must be concerned.

(6) The other ethylene scavenger compounds should be studied to enhance ethylene scavenger capacity of PP/organomodified bentonite active packaging film.