CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Porous Clay Heterostructure (PCH) is a porous material that can be prepared by the polymerization of tetraethoxysilane (TEOS) in the presence of surfactant micelles within the galleries of bentonite. The functionalized PCH with amino group which was named APPCH can be prepared by co-condensation reaction in the galleries of bentonite. Chromophores, bromothymol blue and methyl red, were added to the PCH and APPCH respectively to obtain the coloricmetric properties for smart films. To confirm the formation of porous structure, the products were characterized by N_2 adsorption-desorption, XRD, SEM and FTIR techniques. The results revealed that PCH had the high surface areas of 524.1 m^2/g, average pore diameter of 4.85 nm and pore volume of 0.64 cc/g while the functionalized PCH (APPCH) had the less surface area and pore volume in the range of 119.8-320.5 m^2/g and 0.33-0.42 cc/g, respectively. The rugged surface of SEM image and no sharp peaks from XRD spectra was used to confirm the porous structure in APPCH and PCH. In addition, surface area and pore volume of APPCH and PCH decreased after modified with pH-dye indicated that the incorporation of pH dye in APPCH and PCH was successful. A color indicator for detecting fish and climacteric fruit freshness was developed based on PP/APPCH-MR nanocomposite films and LDPE/PCH-BTB nanocomposite films respectively. The results showed that the increase of total volatile basic nitrogen (TVB-N) values from 0-8 hours corresponded to the color change of indicator films from red to light orange during fish spoilage. The color change of indicator films from green to yellow correlated with standard CO_2 levels, which can be compared to CO_2 levels from respiration during fruit ripening. These pH indicator films could be used to determine fish freshness and can be applied for detecting the quality of climacteric fruit by color change. The both nanocomposites showed the higher thermal stability due to the presence of porous clay in nanocomposite. Moreover, both nanocomposite showed the improvement in oxygen barrier properties.

7.2 Recommendations

Based on what we have been discovered in this study, the following recommendations are suggested in following scopes.

(1) Study on the use of other indicator type in order to develop smart packaging to be more effective.

(2) Study at low/refrigerated temperature

(3) Study on the use of indicator film for the other types of climacteric fruits such as mango and durian.