CHAPTER VII
CONCLUSIONS AND RECOMMENDATIONS

Porous clay heterostructures (PCHs) has been synthesized by a surfactant directed assembly of silica species within the clay galleries. In this work, Surface PCH was modified by the ferric chloride hexahydrate and ferrous chloride tetrahydrate to obtain the magnetic PCH. Then, the various Mn ion (Manganese (II) chloride tetrahydrate) contents were added into magnetic PCH to enhance the magnetic properties. From the analysis of N_2 adsorption-desorption data, the results show that PCH had surface areas of 659.30 m^2/g, an average pore diameter was 3.07 nm, and pore volume was 0.51 cc/g, while magnetic PCHs had a result of 241-351.05 m^2/g, average pore diameter in the range of 5.33-7.15 nm and pore volume of 0.40-0.46 cc/g, respectively. Moreover, the shape of the N_2 adsorption-desorption isotherms of these products are very similar which belong to a type IV BET isotherm, and also indicated that the framework pore sizes are in the supermicropore to small mesopore region. A strong peak was observed at the low angle in the XRD patterns of PCH. This showed the existence of porous structures within the clay galleries. EDX micrographs and UV adsorption of magnetic PCHs showed successful incorporation of Fe and Mn ions in PCH. The saturation magnetization value increases with higher the Mn concentrations as investigated by VSM. However, Magnetic PCHs without Mn is practical to modify their surfaces by VCI because of the highest moisture adsorption. Following that, surface of magnetic PCH (20% wt Fe ions and 0%wt Mn) was modified by various VCI contents and the magnetic PCHs nanocomposites of PLA were prepared via direct melt intercalation by using a twin screw extruder. The dispersion of the magnetic PCH-VCIs in PLA matrix was improved by incorporating 5 wt% of PEG as a plasticizer. Subsequently, they were fabricated to thin sheet by compression molding machine. According to thermal properties, the T_g and T_m of PLA/5%wt PEG were lower than those of neat PLA. The thermal properties of PLA nanocomposites insignificantly change with higher VCI contents in magnetic PCH and the mechanical properties of PLA nanocomposite decreased with higher VCI contents in magnetic PCH. After corrosion test (86.5% RH at 20°C), the PLA nanocomposite showed lower corrosion rate as compare with neat PLA and the incorporation of 40%wt VCI on magnetic PCH showed the lowest corrosion. To study effects of various Magnetic PCH-40%wt VCI on the properties of PLA nanocomposites, PLA nanocomposites with various Magnetic PCH-40%wt VCI were prepared. For the properties of PLA nanocomposites, the thermal properties of PLA nanocomposites marginally increased with higher magnetic PCH-VCI content. From the XRD result, the structure of PLA nanocomposites with 1 %wt Magnetic PCH- 40 %wt VCI possibly showed good exfoliations. On the contrary, PLA nanocomposites with 3 and 5 %wt Magnetic PCH- 40 %wt VCI showed the intercalations. After testing the corrosion, surface of carbon steel specimens was changed from roughness to smooth surface. This showed the layer of VCI on the carbon steel surface. The anticorrosion properties increased with higher magnetic PCH-VCI contents while the mechanical properties decreased with higher magnetic PCH-VCI contents. Moreover, the oxygen and moisture permeability of PLA nanocomposites decreased with increasing magnetic PCH-VCI content due to gas barrier properties of the magnetic PCH-VCI providing tortuous path in the films. Commercial uses, the anti-corrosion packaging which made from PP/VCI or PE/VCI was packed in moisture barrier bags, stored in a sealed container in a dry warehouse and avoids direct exposure to sunlight with temperatures not exceeding 65°C. Under these conditions, shelf life of the packaging is up to 24 months.

Recommendations

The incorporation of VCI on the magnetic PCH should be synthesized by several VCI types. Besides, the qualitative analysis of VCI volatilization should be investigated and the quantitative analysis of VCI volatilization should be calculated. Moreover, the polylactide nanocomposites should be blended at various ratios of polymer/compatibilizer/nanofiller to find the suitable generic for blowing film. The mechanical effects and the shelf life of those films should be investigated.