CHAPTER V

CONCLUSION

Banana starch is a new material that can be used to make the biodegradable plastic. After being extracted in 0.05N NaOH, it was found that the shape of banana starch granules ranged from oval to irregular. Its size varied from 5 – 45 μm in diameter. The average size was estimated to be about 21 – 24 μm. The gelatinization temperature and degradation temperature were found to be in the range of 72 - 78°C and 310 – 345°C, respectively. The density measured by picnometric technique was 1.74 g/cm^3. Percent yield of starch in green banana was 19.6% (wet dry basis) and 57.72% (dry weight basis).

The melting temperature of LDPE/starch blends was determined from DSC thermograms. No change was observed in the melting temperature of LDPE in any of the blends. The percent crystallinity of the LDPE phase in the blends decreased as EVA content increased. For TGA measurement, the blends of LDPE with starch showed two decomposition stages. The first stage around 310 – 340°C is due to starch decomposition. The second stage near 454°C is due to LDPE decomposition. The degradation temperature of starch shifted towards low temperature as the amount of banana starch increased. On the other hand, thermal stability of the films increased with respect to the amount of EVA.

Moisture absorption of the pure LDPE film was almost 0%, whereas for the LDPE/banana starch blend films, their moisture absorption increased as the amount of banana starch increased. These results ensure that banana starch is more hydrophilic than LDPE, leading to an enhancement of hydrogen bond formation between hydroxyl groups in the starch and moisture. The compatibilized blends with EVA absorbed less moisture than uncompatibilized blends.

With increasing banana starch content, tensile strength and elongation at break of LDPE/banana starch blends decreased, as opposed to the increase in biodegradation. After degradation, the LDPE film was not degraded either in activated sludge or under enzymatic treatment, while the LDPE films containing various amount of banana starch were obviously degraded under these two conditions as a function of starch content. Furthermore, the degradation rate of the films exposed to enzymatic degradation was higher than those subjected to activated sludge, indicating that the enzyme α - amylase directly help promoting the biodegradation prior to other disintegrations occur. These results can be explained that as the starch content increases, there are more sites on the film surface that can be attacked by microorganisms. The presence of many minute voids seen in the SEM micrographs of the LDPE/banana starch films confirmed the result that banana starch was removed from the LDPE matrix after biodegradation, resulting in the decrease in tensile strength and elongation at break of the LDPE/banana starch films. Although, the addition of EVA in the polymer blends led to an increase in tensile properties; it was, however, found that the biodegradability of the films having an EVA as a compatibilizer was slightly less than those films without EVA.