

CHAPTER V

CONCLUSION

Banana starch and benzophenone were found to be an effective additive in LDPE film since they promoted the photo-biodegradation of this polymer. The presence of both additives in the blends led to a material which can be degraded faster than pure LDPE.

The decomposition temperature of the blend films was determined from TGA measurement. The blend films showed two decomposition stages. The first stage around 290-300°C is due to starch decomposition. The second stage around 450°C is due to LDPE decomposition. For DSC measurement, no change was observed in the melting temperature of LDPE in any of the blends.

Tensile strength and elongation at break of the blend films decreased with increasing amount of starch. However, benzophenone had no effect on the tensile properties of the blend films. The addition of PE-g-MA as a compatibilizer into the blend increased the tensile properties compared with the uncompatibilized blend.

As the banana starch content increased, carbonyl index of the blend films after an outdoor exposure increased whereas the tensile properties decreased. Banana starch which was intended to function as a biodegradation additive also enhanced the photodegradation of the films by increasing the number of holes in the LDPE matrix. With increasing banana starch content, there are more gaps between LDPE and starch granule that allow the permeation of light and oxygen into the inner part of LDPE, causing the photodegradation of the blend films. In addition, after biodegradation by microorganism and soil burial test, the LDPE film was not degraded while the LDPE films containing various amount of banana starch were obviously degraded as a function of starch content. These results can be explained that as the starch content increases, there are more sites on the film surface that can be attacked by microorganism. The

presence of the tiny holes seen in SEM micrographs of LDPE/starch blend films confirmed the result that the banana starch was removed from LDPE matrix after biodegradation, resulting in the increasing in weight loss and the reduction in tensile properties of the blend films.

Although the addition of PE-g-MA in the polymer blend films led to an increase in tensile properties, however, it was found that the biodegradability of the film containing PE-g-MA as a compatibilizer was slightly less than these films without PE-g-MA. This might be implied that the compatibilizer has an inhibiting effect to the degradation of the blend films. The effect of PE-g-MA may be due to the bonding between anhydride groups of PE-g-MA and hydroxyl groups of starch, which obstructs the consumption of starch from microorganism.

Benzophenone functioned as a good photosensitizer for the LDPE/starch blend films. The photodegradation of LDPE/starch films increased with increasing benzophenone content as determined by an increase in carbonyl index as well as a decrease in tensile properties of the films after the photodegradation test. This is due to the increase in number of double bonds which are more easily oxidized and generated free radicals. The more radicals in the system lead to an increase in the probability for carbonyl formation and breakdown the long polymer chain into the shorter ones, resulting in the reduction in both tensile strength and elongation at break of the blend films. However, the results revealed that benzophenone had a small inhibiting effect on the biodegradation rate of LDPE/starch films.

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