CHAPTER 6

CONCLUSION

The injection high density polyethylene was degraded by natural weathering and accelarated weathering using tubular low-pressure mercury-vapour fluorescent lamps and medium pressure mercury lamp. In order to increase the rate of photodegradation , 2-photosensitizers , anthraquinone and benzophenone in a ratio of 1:1 , were added to high density polyethylene in a concentration of 1.0 , 1.5 and 2.0 % by weight. The results of degradation rates of both undoped and doped high density polyethylene at various concentrations were compared and a correlation between undoped and doped high density polyethylene was obtained. All high density polyethylen sheets , of 0.4 mm. thickness , were exposed to outdoor elements during a six months exposure period , irradiated with 4-fluorescent lamps for 33 days and irradiated with medium pressure mercury lamps for 240 hours. The properties before and after irradiation were examined by four methods : tensile strength , elongation at break , molecular weight by viscosity method and fourier transform infrared absorption. Changes of the degradation tendencies and degradation rates by natural weathering and accelerated weathering of both undoped and doped high density polyethylene were obtained. Then the results of the accelerating tests and the outdoor exposure were compared. Thus , correlation between outdoor and accelerated weathering were obtained. The photodegradation mechanisms for undoped and doped high density polyethylene are proposed on the basis of the experimental results. The results are summarized as follows :

1. The degradation reaction of undoped high density polyethylene proceed evenly in the first 30 days of outdoor

exposure. The tensile strength and molecular weight decrease strongly after 30 days. The molecular weight is about 75 % of the starting value at the second month and the concentration of the vinyl and carbonyl groups formed during the weathering are high. The elongation at break decreases rapidly after 15 days and approaches zero after 3 months off outdoor exposure.

2. The degradation tendencies of undoped high density polyethylene irradiated with 4-fluorescent lamps are similar to undoped high density polyethylene under natural weathering. The decrease in the degradation rate of sheets occurred almost regularly during the whole period of irradiation. The elongation at break decreased to almost 100 % after 24 days of irradiation.

3. Changes of tensile strength and elongation at break of both undoped and doped high density polyethylene irradiated with medium pressure mercury lamp takes place suddenly after irradiation. Thus , the elongation at break could not be measured from this test. It was clarified that the medium pressure mercury lamp experiment shows the highest acceleration with regards to the tensile properties.

4. the molecular weight and elongation at break of doped high density polyethylene irradiated by natural weathering and accelerated weathering sharply diminished after irradiation. The degradation rate of high density polyethylene containing 2-photosensitizers is higher than that of undoped high density polyethylene.

5. As regard the concentration of photosensitizers in high density polyethylene sheets , the higher the concentration the higher the degradation rate. The difference in degradation

rate of photosensitizing high density polyethylene at various concentration is small. Thus with regards to the economics of polymer production , the lowest concentration of photosensitizers should be appropriate. At this point , more studies should be conducted.

At present , there are more advances in the use of plastics , but at the same time the steadily increasing proportion of plastics is now causing major problems of handling and disposal of domestics and industrial wastes. Thus , this work contribute a little bit to the solution of plastic waste problem by incorporating photosensitizers into plastics. When these plastics are exposed to UV light , chains of polymers are broken and mechanical characteristics are destroyed. However , plastic degradation should be studied further in the aspect of

1. Degradation for other kinds of polymers.
2. The effect of other types of photosensitizers.
3. The optimum concentrations of photosensitizers.
4. production cost of photosensitizing polymers.