

Abstract

Plastic bags mostly made of polyethylene (PE) cause pollution as solid waste due to their non-degradability nature. Initiation of a degradative process by enhanced photo-oxidation is a possible method for an accelerated degradation. This paper presents temperature treatment effects on PE films where photodegradation was initiated using ultraviolet (UV) irradiation in the ranges of 200–300 nm and 300–400 nm for 2 hr. Effects of temperature of 40°C and 55°C on non-UV-irradiated and UV-irradiated PE films processed by conventional methods were investigated and evaluated after 50 hr, 150 hr, and 350 hr of temperature exposure. The effects of UV wavelength range irradiation on the degradation were deduced. Measuring the dynamic moduli using a dynamic mechanical analyzer monitored the degradation. The decrease in average storage modulus was 62% with treatment at 55°C, higher than the 16% drop at 40°C for unirradiated samples after 350-hr exposure. Cross-linking in UV-exposed samples, characterized by an increase in dynamic modulus (stiffening), was observed followed by a reduction of storage modulus. Temperature treatment at 55°C together with 300–400-nm UV range irradiation resulted in the largest increase, i.e., 22% after 150 hr, followed by the largest reduction of storage modulus, i.e., 74.6% for a cumulative 350-hr exposure.