JOURNAL OF Applied Polymer SCIENCE

Enhanced degradation properties of polypropylene integrated with iron and cobalt stearates and its synthetic application

Malini Subramaniam,[†] Swati Sharma,[†] Arun Gupta, Norhayati Abdullah
Faculty of Chemical Engineering and Natural Resources, Universiti Malaysia Pahang, Gambang Pahang, Malaysia 26300
M. Subramaniam and S. Sharma contributed equally to this article.
Correspondence to: A. Gupta (E-mail: arungupta10@gmail.com)

ABSTRACT: Synthetic plastic leads to environmental contamination, and a promising solution to this problem is to use prooxidants as fillers within them to speed up the photooxidation and thermooxidation processes. This makes plastics more susceptible to biodegradation. In this study, the degradation properties of the widely used polymer polypropylene (PP) were improved by integration with cobalt stearate ($CoSt_2$) and iron stearate ($FeSt_3$) as prooxidants with accelerating weathering degradation. The metal stearates were blended with PP in the concentration range 0.1–0.9% w/w. The properties of the blends were studied by mechanical properties testing, thermogravimetric analysis, differential scanning calorimetry, and water absorption measurement. We performed the degradation properties and thermooxidative studies by conducting an accelerated weathering test on PP–metal salt blends. Fourier transform infrared spectroscopy and scanning electron microscopy analysis of the samples before and after the accelerated weathering test were performed to study the extent of degradation in PP-based metal salt blends. The results indicate that the tensile strength was inversely proportional to the concentration of metal stearates, and the samples showed an increased degree in polymer crystallinity (PPFe5 > PPCo5), and this led to the degradation of PP in less time. $CoSt_2$ predominantly enhanced the degradation of PP in comparison to $FeSt_3$. Food containers and pots were constructed with the tailored polymers of PP in the injection-molding machine. Thus, metal-stearate-integrated polymers have great industrial potential to generate value-added products. J. Appl. Polym. Sci. **2017**, *135*, 46028.

KEYWORDS: blends; degradation; extrusion; mechanical properties; thermal properties

Received 3 July 2017; accepted 3 November 2017
DOI: 10.1002/app.46028