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PHB/V—A Natural Biodegradable Thermoplastic Polymer

Fionnuala Wynne

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ENVIRONMENTAL DEGRADATION OF POLY(ETHYLENE TEREPHTHALATE) BY HYDROLYSIS

MICHÈLE EDGE, MEHRDAD MOHAMMADIAN, and NORMAN ALLEN

Crystalline and amorphous poly(ethylene terephthalate) (PET) sheet have been exposed to both thermal and UV aging. Environmental breakdown has been emphasized by aging in dry and wet soils and at low and high humidities in the absence and presence of UV irradiation. Degradation has been monitored by viscometric (chain scission) and density measurements. Results indicate that hydrolysis is the dominant mode of degradation in both materials at ambient temperatures. For highly oriented PET, both chain-scission and crosslinking are evident. In the case of amorphous materials, crystallinity exhibits an initial increase due to plasticization and annealing. This is followed by rapid chain scission. Thereafter, degradation proceeds at a reduced rate with a combination of hydrolytic and oxidative mechanisms taking place. Density increases have not previously been attributed to hydrolytic annealing but have rather been considered to be due to a chemicrystallization [1] process. The two processes are presented and discussed, with evidence for hydrolytic annealing being supported with data from thermal aging under dry conditions and UV irradiation. In view of the results obtained, current physicochemical test techniques used for monitoring the environmental breakdown of PET are evaluated.

REFERENCE

[1] A. Ballara and J. Verdu, *Polym. Degrad. Stab.*, *26*, 361 (1989).

PHB/V—A NATURAL BIODEGRADABLE THERMOPLASTIC POLYMER

FIONNUALA WYNNE

"Biopol" is ICI's trademark for a range of fully biodegradable thermoplastic polyesters produced from renewable raw materials. They are composed of hydroxybutyrate (HB) units with between 0 and 30% of hydroxyvalerate (HV) units incorporated randomly throughout the polymer chain.

Because they share many of the properties of traditional plastics, they can be processed on conventional equipment using conventional technology to produce

molding, containers, coatings, laminates, films, and fibers. Just like conventional plastics, products produced from PHB/V are stable in use, durable, and moisture resistant. They may be reused or recycled, and upon incineration release only CO_2 and water. "Biopol" differs from traditional plastics in being naturally derived. The homopolymer, PHB, is widely found throughout nature where it is produced by microorganisms as a carbon and energy store. PHB/V is recognized by the environment as a foodstuff, and it is this recognition which confers true biodegradability to the entire polymer range.

The large-scale production of these polymers simply intensifies the natural process and is based on the fermentation of glucose from annually renewable agricultural feedstocks such as sugar beet and cereals. In the future there is also the potential to use such agricultural by-products as molasses and whey. The process uses low temperatures and pressures, and it generates no harmful gaseous, aqueous, or solid effluents.

In addition, PHB is particularly compatible with mammalian tissue and blood. It is recognized by the human body, where the monomer of PHB is itself a normal metabolite in mammalian blood.

PHB/V has the functionality of traditional plastics, is produced from sugar in a simple and safe fermentation process, and is truly biodegradable. It answers the consumer's demand for natural products and the converters need for performance. In addition, "Biopol" is compatible with all existing and developing waste management technologies, and thus offers the security of environmentally responsible disposal. It is particularly suited to municipal composting, can be safely incinerated, and can be recycled.