Accepted Manuscript

Enzymatic degradation of poly (butylene succinate-*co*-hexamethylene succinate)

Siwen Bi, Bin Tan, James L. Soule, Margaret J. Sobkowicz

PII: S0141-3910(18)30209-X

DOI: 10.1016/j.polymdegradstab.2018.06.017

Reference: PDST 8582

To appear in: *Polymer Degradation and Stability*

Received Date: 4 April 2018

Revised Date: 21 June 2018

Accepted Date: 27 June 2018

Please cite this article as: Bi S, Tan B, Soule JL, Sobkowicz MJ, Enzymatic degradation of poly (butylene succinate-*co*-hexamethylene succinate), *Polymer Degradation and Stability* (2018), doi: 10.1016/j.polymdegradstab.2018.06.017.

Enzymatic Degradation of Poly (butylene succinate-*co*-hexamethylene succinate)

Siwen Bi[1], Bin Tan[1], James L. Soule[1], Margaret J. Sobkowicz[1,*]

[1]Department of Plastics Engineering, University of Massachusetts Lowell, Lowell, Massachusetts, USA

*Margaret_sobkowiczkline@uml.edu

Abstract

Poly (butylene succinate) (PBS) is an important bio-based and biodegradable polymer and attracts lots of attention stemming from its good mechanical properties that are complementary to other biobased polyesters. PBS has relatively slow biodegradation due to its high degree of crystallinity, which limits its utility in targeted applications. It is known that enzymatic degradation depends on polymer chemistry, solid-state morphology (i.e. crystallinity degree), molecular weight and other structural factors. In this paper, PBS-based copolyesters were synthesized through a melt polycondensation process and enzymatic degradation was carried out using lipase from Candida rugosa. Rate of enzymatic degradation and thermal properties were found to vary depending on the ratio of butanediol to hexanediol in the copolymer. The combined analysis of the enzymatic degradation rate and change in the morphology and molecular weight of a series of PBS-based copolyesters demonstrated the relative contributions of polymer chemistry, thermal properties and crystallinity. PBS-based copolyesters with tunable enzymatic degradation show promise as a more sustainable substitute for non-biodegradable plastics in agriculture and packaging industries.

Keywords: Poly (butylene succinate) copolymer; enzymatic degradation; crystallinity

1. Introduction

From 1950 to 2015, the annual production of global plastics increased by 320 million tons, and all plastics waste ever generated reached 5800 million metric tons.[1,2] With the dramatic increase of plastics production and consumption, society faces increasing environmental pollution of air, soil and water sources.[3,4] The heavy