Biodegradable Polymers Based on Renewable Resources. IV. Enzymatic Degradation of Polyesters Composed of 1,4:3.6-Dianhydro-D-glucitol and Aliphatic Dicarboxylic Acid Moieties

MASAHIKO OKADA, KENJI TSUNODA, KOUJI TACHIKAWA, KEIGO AOI

Department of Applied Molecular Biosciences, Graduate School of Bioagricultural Sciences, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan

Received 11 May 1999; accepted 19 September 1999

ABSTRACT: Enzymatic degradation of a series of polyesters prepared from 1,4:3.6-dianhydro-D-glucitol (**1**) and aliphatic dicarboxylic acids of the methylene chain length ranging from 2 to 10 were examined using seven different enzymes. Enzymatic degradability of these polyesters as estimated by water-soluble total organic carbon (TOC) measurement is dependent on the methylene chain length (m) of the dicarboxylic acid component for most of the enzymes examined. The most remarkable substrate specificity was observed for *Rhizopus delemar* lipase, which degraded polyester derived from **1** and suberic acid (m = 6) most readily. In contrast, degradation by *Porcine liver* esterase was nearly independent of the structure of the polyesters. Enzymatic degradability of the polyesters based on three isomeric 1,4:3.6-dianhydrohexitols and sebacic acid was found to decrease in the order of **1**, 1,4:3.6-dianhydro-D-mannitol (**2**), and 1,4:3.6-dianhydro-L-iditol (**3**). Structural analysis of water-soluble degradation products formed during the enzymatic hydrolysis of polyester **5g** derived from **1** and sebacic acid has shown that the preferential ester cleavage occurs at the O(5) position of 1,4:3.6-dianhydro-D-glucitol moiety in the polymer chain by enzymes including *Porcine pancreas* lipase, *Rhizopus delemar* lipase, and *Pseudomonas sp.* lipase. © 2000 John Wiley & Sons, Inc. J Appl Polym Sci 77: 338–346, 2000

Key words: biodegradable polymers; 1,4:3-6,dianhydro-D-glucitol; enzymatic degradation

Correspondence to: M. Okada.

Contract grant sponsor: Ministry of Education, Science, Sports, and Culture of Japan; contract grant number: 8555234 and 11217208.

Journal of Applied Polymer Science, Vol. 77, 338–346 (2000)