Biodegradable Polymers Based on Renewable Resources. IX. Synthesis and Degradation Behavior of Polycarbonates Based on 1,4:3,6-Dianhydrohexitols and Tartaric Acid Derivatives with Pendant Functional Groups

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Received 5 January 2005; accepted 17 March 2005
DOI: 10.1002/pola.20830
Published online in Wiley InterScience (www.interscience.wiley.com).

ABSTRACT: Novel polycarbonates, with pendant functional groups, based on 1,4:3,6-dianhydrohexitols and L-tartaric acid derivatives were synthesized. Solution polycondensations of 1,4:3,6-dianhydro-bis-*O*-(*p*-nitrophenoxycarbonyl)hexitols and 2,3-di-*O*-methyl-L-threitol or 2,3-*O*-isopropylidene-L-threitol afforded polycarbonates having pendant methoxy or isopropylidene groups, respectively, with number average molecular weight (M_n) values up to $3.6_1 \times 10^4$. Subsequent acid-catalyzed deprotection of isopropylidene groups gave well-defined polycarbonates having pendant hydroxyl groups regularly distributed along the polymer chain. Differential scanning calorimetry (DSC) demonstrated that all the polycarbonates were amorphous with glass transition temperatures ranging from 57 to 98 °C. Degradability of the polycarbonates was assessed by hydrolysis test in phosphate buffer solution at 37 °C and by biochemical oxygen demand (BOD) measurements in an activated sludge at 25 °C. In both tests, the polycarbonates with pendant hydroxyl groups were degraded much faster than the polycarbonates with pendant methoxy and isopropylidene groups. It is noteworthy that degradation of the polycarbonates with pendant hydroxyl groups was remarkably fast. They were completely degraded within only 150 min in a phosphate buffer solution and their BOD-biodegradability reached nearly 70% in an activated sludge after 28 days. The degradation behavior of the polycarbonates is discussed in terms of their chemical and physical properties. J Polym Sci Part A: Polym Chem 43: 3909–3919, 2005
Keywords: polycarbonate; renewable resources; dianhydrohexitol; tartaric acid; hydrolysis

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Journal of Polymer Science: Part A: Polymer Chemistry, Vol. 43, 3909–3919 (2005)