Biodegradable Polymers Based on Renewable Resources VIII. Environmental and Enzymatic Degradability of Copolycarbonates Containing 1,4 : 3,6-Dianhydrohexitols

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ABSTRACT: Environmental and enzymatic degradations were investigated on a series of copolycarbonates consisting of equimolar amounts of 1,4 : 3,6-dianhydrohexitols (1,4 : 3,6-dianhydro-D-glucitol (**1a**) and 1,4 : 3,6-dianhydro-D-mannitol (**1b**)) and alkylene diols (1,4-butanediol, 1,6-hexanediol, 1,8-octanediol, and 1,10-decanediol) or oligo(ethylene glycol)s (di-, tri-, and tetraethylene glycols). Fourteen different copolycarbonates with number average molecular weights in the range of 1.1–4.2 $\times$ 10^4 were prepared by solution polycondensation as described in our previous article. Biodegradability of the copolycarbonates was assessed by soil burial degradation tests in composted soil at 27 °C and by enzymatic degradation tests in a phosphate buffer solution at 37 °C. In general, biodegradability of the copolycarbonates increased with increasing chain lengths of the methylene groups of alkylene diols or of the oxyethylene groups of the oligo(ethylene glycol)s. SEM observations of the film surfaces of polymers recovered from soil burial indicated that the copolycarbonates were degraded by microorganisms in soil. In enzymatic degradation, the copolycarbonates containing alkylene diol components showed high degradability with *Pseudomonas* sp. lipase, whereas the copolycarbonates containing oligo(ethylene glycol) components were not degraded at all. The enzymatic degradability of the copolycarbonates is discussed with reference to the geometrical structure around the carbonate linkages and the microstructure and hydrophobicity of the polymer chains.
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