Biodegradable Polymers Based on Renewable Resources. V. Synthesis and Biodegradation Behavior of Poly(ester amide)s Composed of 1,4:3,6-Dianhydro-D-glucitol, α-Amino Acid, and Aliphatic Dicarboxylic Acid Units

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ABSTRACT: A series of poly(ester amide)s were synthesized by solution polycondensations of various combinations of *p*-toluenesulfonic acid salts of *O*,*O′*-bis(α-aminoacyl)-1,4:3,6-dianhydro-D-glucitol and bis(*p*-nitrophenyl) esters of aliphatic dicarboxylic acids with the methylene chain lengths of 4–10. The *p*-toluenesulfonic acid salts were obtained by the reactions of 1,4:3,6-dianhydro-D-glucitol with alanine, glycine, and glycylglycine, respectively, in the presence of *p*-toluenesulfonic acid. The polycondensations were carried out in *N*-methylpyrrolidone at 40°C in the presence of triethylamine, giving poly(ester amide)s having number-average molecular weights up to 3.8 $\times 10^4$. Their structures were confirmed by FTIR, ^{1}H-NMR, and ^{13}C-NMR spectroscopy. Most of these poly(ester amide)s are amorphous, except those containing sebacic acid and glycine or glycylglycine units, which are semicrystalline. All these poly(ester amide)s are soluble in a variety of polar solvents such as dimethyl sulfoxide, *N*,*N*-dimethylformamide, 2,2,2-trifluoroethanol, *m*-cresol, pyridine, and trifluoroacetic acid. Soil burial degradation tests, BOD measurements in an activated sludge, and enzymatic degradation tests using *Porcine pancreas* lipase and papain indicated that these poly(ester amide)s are biodegradable, and that their biodegradability markedly depends on the molecular structure. The poly(ester amide)s were, in general, degraded more slowly than the corresponding polyesters having the same aliphatic dicarboxylic acid units, both in composted soil and in an activated sludge. In the enzymatic degradation, some poly(ester amide)s containing dicarboxylic acid components with shorter methylene chain lengths were degraded more readily than the corresponding polyesters with *Porcine pancreas* lipase, whereas most of the poly(ester amide)s were degraded more rapidly than the corresponding polyesters with papain. J Appl Polym Sci 81: 2721–2734, 2001

Key words: biodegradable polymer; poly(ester amide); polycondensation; 1,4:3,6-dianhydro-D-glucitol; enzymatic degradation

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