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研究论文

预聚-酶催化缩聚法合成超支化聚酯及其结构表征

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- 摘要
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摘要 以丙三醇、1,6-己二醇和己二酸为共聚单体, 以固定化脂肪酶 Novozym 435 为催化剂, 尝试先进行共聚单体的预聚后在有机介质中进行酶催化直接缩聚反应合成脂肪族超支化聚酯的新途径, 考察了反应介质和反应温度对酶催化缩聚反应的影响, 并采用凝胶渗透色谱和核磁共振确定产物的分子量和结构. 结果表明, 将单体的预聚与酶催化缩聚反应相结合, 可在温和的反应条件下合成超支化脂肪族聚酯; 在所考察的有机介质中以甲苯的效果最佳, 且在 70 oC 时脂肪酶 Novozym 435 催化活性最高, 所得产物的支化度为 0.27, 重均分子量为 1.31×104.

关键词: 预聚合 酶催化缩聚 超支化聚酯 支化度 脂肪酶

Abstract: A new route for hyperbranched aliphatic polyester by the prepolymerization of comonomers followed by the enzymatic condensation polymerization in organic media was developed using glycerol, 1,6-hexanediol, and adipic acid as comonomers and using immobilized lipase Novozym 435 as a biocatalyst. The organic solvents, such as isooctane, toluene, tert-butanol, tetrahydrofuran, and acetone, were used as the reaction medium for enzymatic condensation polymerization. The effects of reaction medium and reaction temperature on the enzymatic condensation polymerization were investigated. The molecular mass and the structure of the prepared polyesters were characterized by gel permeation chromatography and NMR. The results indicated that the hyperbranched aliphatic polyester could be successfully synthesized under the mild conditions by the combination of prepolymerization of comonomers with enzymatic condensation polymerization in organic media. Toluene was the best reaction medium among the examined ones, and the lipase Novozym 435 exhibited the highest activity at 70 ^{o}C within the temperature range from 50 to 90 ^{o}C. The polyester prepared by prepolymerization and the enzymatic condensation polymerization in toluene at 70 ^{o}C possessed the maximal molecular mass of up to 1.31×10^{4} and the branching degree of about 0.27.

Keywords: prepolymerization, enzymatic condensation polymerization, hyperbranched polyester, branching degree, lipase

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