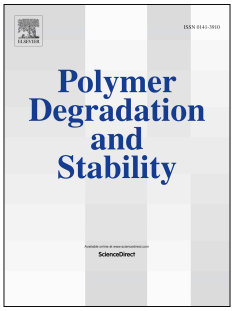

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Enzymatic degradation of synthetic poly(3-hydroxybutyrates) as a tool for combinatorial microstructure determination

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Abstract

Microstructure of synthetic poly(3-hydroxybutyrate) (PHB) prepared by catalytic ring opening polymerization of β-butyrolactone determines the merit of the polymer for applications. Depending on the catalyst used, synthetic PHB can possess a complex microstructure, elucidation of which is not always straightforward. One of such PHBs is analyzed in this work using fractionation of the polymer, differential scanning calorimetry, X-ray powder diffraction, ^{1}H and ^{13}C NMR spectroscopy and, particularly, enzymatic hydrolysis. Only by correlation of the data obtained from different analytic methods, the detailed structural elucidation of the synthesized polymer becomes possible. That is, the bulk polymer features isotactic and syndiotactic enrichment at the same time. Based on the results of the analyses, a multi-stereoblock microstructure of the studied synthetic PHB is ruled out, suggesting a negligible rate of chain transfer / shuttling / transesterification reactions compared to polymerization rate under the applied conditions. An enantiomorphic site control of stereoregularity both for isotactic and for syndiotactic enchainment is found.

Keywords: biodegradable polyesters, ring-opening polymerization, microstructure analysis