Organocatalyzed Synthesis and Degradation of Functionalized Poly(4-Allyloxymethyl-β-Propiolactone)s

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Chemical synthesis of degradable poly(β-hydroxyalkanoate) (PHA) allows the control of solubility, crystallinity, hydrophobicity, degradability, thermal, and mechanical properties by introducing functionality on the side chain. Herein, we synthesized a PHA derivative containing pendent allyl group via anionic ring-opening polymerization of 4-allyloxymethyl-β-propiolactone monomer with organocatalysts in bulk, to yield a series of poly(4-allyloxymethyl-β-propiolactone) (PAMPL) in a controllable molecular weight and dispersity. The prepared PAMPLs were characterized via ^{1}H- and ^{13}C-NMR, GPC, DSC, and MALDI-TOF/TOF. Photoactivated thiol-ene reaction allows the post-polymerization modification of PAMPLs with varying substituents. The degradable nature of the PAMPLs is also carefully monitored upon use of organic bases and thermal conditions. Most importantly, the controlled degradation of cross-linked PAMPL film revealed the high potentials of the prepared PAMPLs.