

Synthesis of polylactide with varying molecular weight and aliphatic content: effect on moisture sorption

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Poly(lactide) (PLA) is a bio-based, biodegradable polymer which is derived from lactic acid and has numerous potential applications, some of which are limited by its moisture barrier and thermal properties. Prior studies have been inconsistent about how moisture sorption in PLA varies with crystallinity and molecular weight. This research is a systematic study of how moisture sorption in PLA depends on molecular weight and aliphatic content via end group modification. PLA with varying aliphatic content is achieved by initiating ring opening polymerization of L-lactide with different long chain aliphatic alcohols. Molecular weight was controlled by varying the ratio of L-lactide monomer to alcohol (C16 Palmityl, C10 Decyl, C4 Butyl) initiator and triethylaluminum was used as a catalyst for precise control over molecular weight. PLA with different molecular weights and with varying end groups were synthesized and characterized by GPC, DSC, and NMR. Moisture sorption in PLA was measured with a quartz crystal microbalance (QCM). QCM experiments revealed that both molecular weight and aliphatic content contribute to sorption properties of PLA.