Functional Materials Based on Biodegradable Polylactide Copolymers: Form Synthesis to Fabrication and Applications

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Polylactide (PLA) has attracted vast attention in both industrial and research community, and has been widely used, owing to its unique biocompatibility and degradability. In our laboratory, various functional materials have been developed based on polylactide copolymers, for example, polylactide-*grafted*-chitosan, polylactide-*co*-polyethylene glycol, polylactide-*grafted*-epoxidized natural rubber, and poly(lactide-*co*-glycidyl methacrylate). Chemical structures and properties of these copolymers have been systematically examined. These materials are intended for use in various applications, especially in packaging, agricultural, cosmetic and biomedical fields, by using specific fabrication process. Introducing of these copolymers as small-amount additives into commercial PLA resin has been conducted to enhance its mechanical property and provide specific function, such as controlled gas permeability and gas selectivity. Micro- and nano-particles with tunable structures, i.e., solid or hollow structures, and morphology have been developed. Active compound-encapsulated particles are also prepared by employing various NSAID and antibiotic drugs and essential oils. Structures, properties, degradability, and toxicity of the resulting particles, and releasing behaviors of the active compounds are examined. Processes for incorporating of polyacrylamide or poly(N-isopropylacrylamide) on PLA film's surface and standard analysis techniques for quantitative characterization of the products are developed The materials have high potential for use as cell culture substrates or scaffolds or pH-sensitive absorbents.