

Synthesis and Characterization of PLA by Melt Polycondensation Using Binary Catalyst System

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ABSTRACT

The properties of a medium molecular weight lactic acid polymer, synthesized by a two-step condensation polymerization of L-lactic acid, were investigated. The oligomer of L-lactic acid was first produced, and was subsequently polymerized with the binary catalysts stannous chloride dihydrate/ p-toluene sulfonic acid. The polymer obtained was characterized using GPC, FTIR, and MDSC. Results showed that polymer synthesized by the binary catalysts system, had significantly higher molecular weight and crystallinity as compared with polymer produced with the conventional stannous-based single catalyst. Discoloration was effectively inhibited by this binary catalysts system. There was no significant change in its T_g. However, double melting peaks were observed on the DSC scan indicating melt-recrystallization occurred. The in-vitro hydrolytic degradation of the polymer, in phosphate buffered solution (PBS) at pH 7.4 and 37°C was followed using gel permeation chromatography (GPC) and thermal analysis (DSC). Mass loss experiments were also carried out to follow the effects of degradation on the polymer films. It was found that hydrolytic chain scission occurred as early as the first week of the degradation, with the decrease in molecular weight and mass.

Keywords: melt polycondensation, binary catalysts system, poly(L-lactide) and in-vitro hydrolytic degradation.