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Thermal characterization of Polylactic Acid by Thermal Analysis

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Biodegradable plastic has gained attention in recent years due to concerns about waste disposal and environmental conservation. Polylactic acid (PLA) is a biodegradable plastic derived from plants and continues to be widely used in packing, fibers and medical materials. Crystallinity is an important consideration for the strength, impact resistance, and transparency requirements of these products and also influences biodegradability. Furthermore, lactic acid, the PLA monomer, has asymmetrical carbon and thus optical isomers. The isomer ratio and molecular weight of polymers influence crystallinity and heat resistance, so they are factors in the molding process.

PLA samples a, b and c had roughly the same molecular weight but different optical isomer L-form/D-form ratios (L-form ratio; a < b < c). And sample c' had the same L-form/D-form ratio as Sample c but its molecular weight was lower (molecular weight; c > c'). Fig.1 shows the DSC curves when the samples were meited and then cooled at 0.1°C/min (A) and quench (B). This result suggest an important relationship between the isomeric ratio and the cooling rate during molding.

In this presentation, the crystallinity and heat resistance of polylactic acid are evaluated using DSC (Differential Scanning Calorimeter) and TG (Thermo Gravimetry). This study shows that DSC can be used to learn about crystallinity and the validity of crystallization conditions. Furthermore, thermal decomposition measurements by TG were able to evaluate heat resistance at molding temperatures.

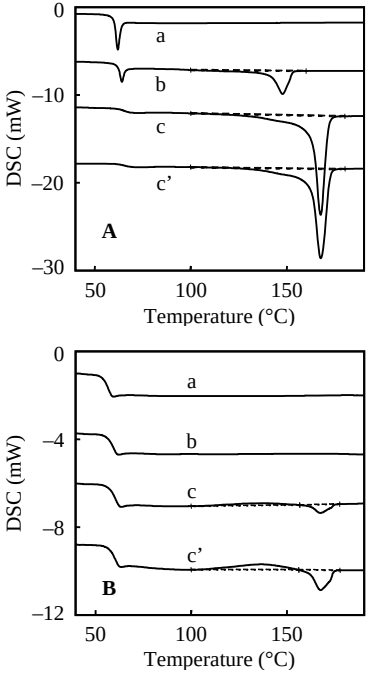

Fig. 1. DSC curves after cooling treatment
A: 0.1°C/min cooling, B: quench