

IOWA STATE UNIVERSITY

Materials Science & Engineering Department

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Final Oral Examination
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“Processing and Characterization of Bio-based Composites”

Much research has focus on bio-based composite as a potential material to replace petroleum-based plastic. Considering the high price for Polyhydroxyalkanoate (PHA), PHA/ Distillers dried grains with solubles (DDGS) composite is a promising economical and high-performance biodegradable material. In this thesis, we discuss the affect of DDGS on the dynamic mechanical, thermal and morphological behaviors of PHA as a novel bio-based polymer composite.

Poly (lactic acid) (PLA) is another excellent bio-base polymer, although its degradation time is relatively long. The goal of this research is therefore to accelerate the degradation process for this material by adding DDGS filler. In addition, DDGS can also improve the dynamic mechanical properties, and decreased the cost of production.

Both bio-based composites were extruded through a twin-screw microcompounder, and the two materials were uniformly mixed. The morphology of the samples was examined using a Scanning Electron Microscopy (SEM). The thermal stability was determined with a Thermal Gravimetric Analyzer (TGA). In addition, Differential Scanning Calorimetry (DSC) was employed to investigate the affect of DDGS on the glass transition temperature and crystallization behavior of both PHA and PLA. The molecular dynamics of bio-based composites were performed as a function of DDGS using a Dynamic Mechanical Analyzer (DMA), and viscoelastic properties were also evaluated using a Rheometer.