CHARACTERIZATION OF BIODEGRADABLE POLYMER BLENDS
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Polymer Processing & Product Development

Mixing & Extruding
- Hand mixing with 5 gallon buckets
- Blend is forced through an EnTek twin-screw extruder with 12 temperature zones

Pelletizing
- Filament is chopped to final desired size to prepare for injection molding

Injection Molding
- Pelletized filament injected at high temperature and pressure into a utensil cast mold
- Final product is then tested to see if desired goals are met.
- Successful blends will be considered for EcNow Tech production this summer.

Product

Thermal Characterization
Differential Scanning Calorimetry (DSC)
Characterizes the thermal properties of the blends and gives the glass transition, melting temperature, and relative crystallinity.

Water Bath Test
The purpose of water bath test is qualitatively to determine the “withstanding time” and heat distortion temperature.

Mechanical Characterization
Three-Point Bend Test
The three point bend test determines the strength and rigidity of the utensils by applying a downward force in the middle of the utensil while recording deflection distance.

The peak load, peak stress and Young’s modulus are recorded and compared across various blends.

Materials
- Poly-Lactic Acid (PLA): Biodegradable polymer, main component of interest
- Co-polymer: Additional polymer that improves thermal properties
- Binding Agent: Additive that binds PLA and the co-polymer together and improves mechanical properties
- Nucleating Agent: Increases crystallinity resulting in improved thermal properties.
- Fillers: Minerals that reduce the cost and improve thermal properties

*All materials are biodegradable.

Results
- Designed blends increase thermal and mechanical properties of utensils
- Blends containing larger amounts of PLA have higher moduli
- Different additives affect the polymer processing
  - Nucleating agent improves injection molding
  - Filler improves extruding

Future Work
- Slightly modify Blend 1 to improve processing.
- Change current processing parameters to improve molding.
- Compare crystallinity of final blend pre- and post-injection molding.

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