Wood and Other Residues in Plastics and Bioplastics

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Outline

- Biopolymers at Scion
- Biofibre (Wood) Plastic Composites
- Fibre in Bioplastics
- Other Bioplastics Work
- Summary
Biopolymers at Scion

- Scion >350 people
- Biomaterials focus
- Utilisation of waste/by-products
- Diversion of waste from landfill
- Utilisation of commercial bioplastics
- Development of novel biomaterials
  - Production of PHAs
  - Production of Bioplastics

Biofibre Plastic Composites

Two main categories:
- Wood filled
  - Reduce plastic cost and improve properties
  - Commonly seen in North America, eg decking
  - Low aspect ratio ‘fibre’ (flour)
  - Cost sensitive markets

- Agri-fibre reinforcement
  - High aspect ratio fibre to reinforce
  - Higher value applications
  - Seen in European automotive applications

⇒ Opportunity for ‘wood fibre’ reinforcement
Residues to Revenues 2009

Processing

- Extrusion
- Injection Moulding

WPC Tensile Modulus

<table>
<thead>
<tr>
<th>Material</th>
<th>Tensile Modulus (GPa)</th>
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<tbody>
<tr>
<td>PP</td>
<td></td>
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<tr>
<td>PP + MAPP</td>
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<tr>
<td>W Flour</td>
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<td>W Flour + MAPP</td>
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<td>MDF</td>
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<td>MDF + MAPP</td>
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<td>Kraft</td>
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<td>Kraft + MAPP</td>
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Residues to Revenues 2009
Residues to Revenues 2009

**WPC Tensile Strength**

- PP
- PP + MAPP
- W Flour
- W Flour + MAPP
- MDF
- MDF + MAPP
- Kraft
- Kraft + MAPP

**Max Tensile Stress (MPa)**

**Effect of Compatibilising MDF**

- Difference in fibre bonding and pull out

**MDF PP**

**MDF PP with coupling**
Fibre Damage During Processing
⇒ Scope for further improvement

Comparison with Commercial Reinforced Polypropylene

With higher loadings, MDF reinforced PP can give strength and stiffness comparable to:
- Commercial flax reinforced PP
- Glass reinforced PP
Wood Plastic Composite Fan Blade

Fibre in Bioplastic

• Wood Fibres
• Polylactic acid (PLA)
  – Corn derived bioplastic
  – Industrially compostable
• With or without coupling agent
Residues to Revenues 2009

Tensile Properties

Impact properties
Other Bioplastics Work

• Modification and incorporation of:
  − Forestry/wood waste
  − Fruit waste
  − Horticultural/Agricultural by-products

Use of Fruit Waste

• Incorporate modified fruit waste into a bioplastic blend

• Improved toughness over unmodified PLA

• Readily compostable pots

• Various commercial trials underway.
Mulford Biopeg®

- Mix of natural, benign, renewable and biodegradable materials
- Tough enough to be hit with a hammer
- Work in the outdoors – resisting wind and rain
- Break down benignly.
Summary

• Patents being completed in various countries for Wood Plastic Composites (WPC)
• Plastics manufacturers trialling our bioplastic materials on commercial products
• Our developments are being applied to a range of plastics and bioplastics
  – Recycled plastics included
• Exploring market and commercial opportunities

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