Bio Coatings for Paper and Fiber Substrates
The Opportunity
Environmental Stewardship

• Improve Sustainability Footprint
  – Reduce dependence on petroleum derived resins
  – Favorable life cycle analysis (LCA)
  – Repulpable
  – Compostable

• Increase brand recognition with earth friendly message

• No opposition within the recycling community
Primary Markets

- Beverage Cups - Hot & Cold
- Take Out Containers
- Wrap - Sandwich/ Deli
- Frozen food and dairy containers
- Ream wrap
The Challenge

• Availability of a suitable bio polymer
  – Polylactic Acid (PLA) most available
  – New capacity added in 2008 to support demand

• Modifying Properties
  – Melt strength
  – Melt curtain stability
  – Adhesion
The Challenge

• Material Handling
  – Dry material (below 400 ppm)
  – Minimal openings in foil liners to reduce exposure to atmosphere
  – Moisture management during processing
  – Re-sealing bags when finished to reduce exposure to moisture
  – Use of dryers in some environments
The Challenge

• Processing
  – Designed for use on existing equipment
  – Lower processing temperatures
    • Target melt temperatures approx 460F-480F
    • Degradation starts at 480F
  – Susceptible to Shear
    • Screw Design Important
    • May not be suitable for high compression ratio screw designs
  – Production speeds near PE or LDPE
  – Minimal equipment or process modification goal
The Challenge

• Price
  – Currently, higher than LDPE
  – Less volatile price fluctuations

• The Right Partner/Brand Owner
Current Bio Polymer Solutions

- PLA based extrusion coatings
  - Commercial since 2006
- First to market - International Paper & Green Mountain Coffee
- Over 1 billion cups produced to date
- Several commercial projects in various stages of development
Current Bio Polymer Solutions

– Properties

• Excellent adhesion to paper and cellulose fiber substrates
• Stiffer, allowing reduction in fiber content
• Good WVTR (25 Micron film) – 375 grams/sq m/24hr @100%RH, 37C
• Good OTR- 700cc/sq m/24 hr @ 0% RH, 23C
• Specific gravity of 1.12
Current Bio Polymer Solutions

– Benefits

• High level of renewable content
• Uses less energy to process
• Compostable – meets ASTM D6400 standards
• Repulpable
• Excellent grease and liquid barrier
• Excellent odor barrier
• Excellent printability
• FDA approved
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Current Bio Polymer Solutions

- Limitations
  - Not suitable for liquid packaging with extended shelf life
  - Price competitiveness vs. current petroleum resin pricing

- Competitive Offerings
  - Limited to date
On the Near Term Horizon

• Master batch version of PLA based resin
  – Lower cost
  – Made from 100% renewable materials
  – Broader processing window
  – Will meet the ATSM D6400 compostability standard
On the Near Term Horizon

• Wax Replacement
  – Drop in replacement for wax
  – 98% renewable materials
  – Lower coat weights than wax
  – Provides additional stiffness
  – More consistent product than wax
  – No residuals resulting from repulping process (deinking conditions)
  – Compostable
  – Competitively priced
Future Solutions

• PHA Polymers (medium to long chain molecular structures)
  – 100% bio based, renewable
  – Food contact, FDA certifiable
  – Suitable for liquid packaging
  – Excellent barrier properties (MVTR, OTR, WVTR)
  – Compostable
  – Biodegradable
    • Will degrade in a cold marine waters, septic tanks, or municipal waste water systems
    • Will degrade both in anaerobic & aerobic conditions
  – Lower cost
  – Broader processing window
  – Commercial quantities available in 12-18 months
Questions?