


# Barrier Coatings Properties, Performance & Sustainability

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## Agenda

- Introduction
- Case Studies
- Sustainability
- Repulpability
- Summary

## Benefits of Water-Based Coatings

- **Functional:** Water, water vapor, gases, oil & grease barrier, heatseal, etc.
- **Aesthetic:** Color, tactile, and spectral properties
- **Versatile:** Plethora of materials; short coating runs
- **Controlled:** Thin film and pattern application
- **Compliant:** Low/No VOC; avoids need for solvent permitting, recovery, incineration, etc.

*Coatings enhance the value of Paper, Film, and Foil.*

## Coating Solutions



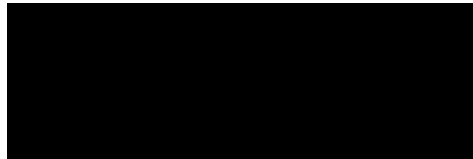
- Performance / Cost Efficiency
- Functionality
- Brand Appeal
- Environmental / Regulatory

## Functionality

- Water Barrier
- Moisture Barrier
- Oil & Grease Barrier
- Many Others

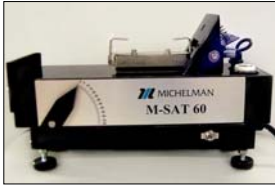


## Controlled COF



*Surface modifiers control coating COF.*

## Controlled COF



The angle of skid is measured and the data is converted to static COF.

*The M-SAT serves as a good indicator of slip resistance.*

## Water & Moisture Barrier

- The coatings system provides:
  - Package integrity
  - Moisture control to help keep produce “alive” and fresh
  - Fully recyclable solution



Produce box made from coated corrugated paper.

## Oil & Grease Barrier

- The coating system provides:
  - An attractive appearance—may be opaque or clear
  - Oil staining resistance
  - Compliance with food contact regulations
  - Kosher certification (Orthodox Union)



The cake pad is not stained by cooking oils at refrigeration and serving temperatures.

## Gas Barrier

Oxygen Barrier  
Odor Barrier



### Practical considerations

- Pinhole-free coating is critical
- Primer or two-pass coating is common
- Ingredient selection is important:
  - Fillers: tortuous path
  - Polymer: block specific gas(es)

## White & Color Coating

- Uniform surface look
  - Clean, colorful background
  - Beautiful contrast to graphics
- Compatibility with water-based inks
- Receptive to digital printing



## Aqueous OPV

Heat resistant OPV retains its original finish despite the rigors of in-process heat and friction.



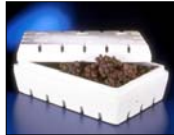
The OPV's toughness is demonstrated in this folding carton application.

### Property Selection

- **High Gloss or Matte:** impart the desired aesthetics
- **Barrier:** block moisture, oil, grease, vapor penetration
- **Heat resistance:** avoid scratch/mar, ink-smear during corrugation
- **Water resistance:** stop water damage on paper

## Case Study: Grapes

- **Incumbent:** Expanded Polystyrene Containers
- **Issues**
  - Containers not easily recyclable
  - Limited package design flexibility
  - Graphics limited to labeling



## Grapes

- **Barrier/Packaging Requirements**
  - Durability for field storage and packing
  - Compatibility with grapes cooling (usually forced air at high humidity)
  - Cold storage
  - Graphics
  - FDA compliance
  - Recyclable/Repulpable
  - Not interfere with fumigants (flow & effectiveness)

## Grapes

- **Barrier Coating Design**
  - Double Coating
    - Base coating is highly effective water barrier (Cobb)
    - Top coating is printable, gluable, heat resistant, and UV resistant for exterior box storage
  - Recyclable/Repulpable
  - Printable
  - Cold-Set and Hot-Melt gluable

## Grapes



## Green Beans

- **Incumbent:** Wire Wound Wooden Crates
- **Issues**
  - Crates Not Recyclable
  - Fragility
  - Potential for Wooden Splinters
  - Not Display Ready
  - Graphics Limited to Labels on Crate Ends



## Green Beans

- **Incumbent:** Wax Cascaded Corrugated
- **Issues**
  - Not Recyclable
  - Additional Weight from the Wax Treatment

## Green Beans

- Barrier Coating Requirements
  - Endure both field packing and shed packing
  - Cooling (forced air at high humidity; cold water; trough cooling)
  - Cold storage
  - Graphics
  - FDA Compliance
  - Recyclable/Repulpable

## Green Beans

- Barrier Coating Design
  - Inside
    - FDA Complaint water resistant coating
    - Gluable
    - Durable
  - Outside
    - Water resistant barrier with color and/or printable surface
    - Gluable
  - Recyclable/Repulpable

## Green Beans



## Sustainability Definition\*

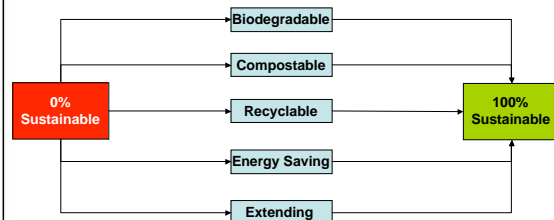
- Beneficial, safe and healthy.
- Meets market criteria for performance and cost.
- Is sourced, manufactured, transported, etc from renewable energy.
- Maximizes the use of renewable or recycled sources.
- Manufactured using clean production technologies and best practices.
- Made from materials healthy in all probable end of life scenarios.
- Physically designed to optimize energy and materials.
- Effectively recovered and utilized in biological and/or industrial cradle to cradle cycles.

\*Source– Sustainable Packaging Coalition

## Overview of Current Efforts

- Early industry focus:
  - Biodegradability
  - Compostability
- Sustainability is a continuum

## What Sustainability Is



## Biodegradable/Compostable Efforts >

- **Examples based on renewable raw materials:**
  - Corn
  - Sugar
  - Wood
  - Switch grass
- **Examples that are biodegradable and/or compostable:**
  - PLA
  - PHA
  - Cellulose



## Current Non-Sustainable Examples >

- **Plastic**
  - OPP, LDPE, PET, PVC, BOPP
- **Corrugated boxes that are treated with petroleum wax**
  - 350 to 450 MM pounds of wax are used each year



## The Evolutionary Step? >

- Permit a greater use of biopolymers or treatments so that more non-sustainable materials can be replaced.
- Provide solutions that allow currently land filled materials to be recycled.
- Recycling gives more turns per pound of raw material.

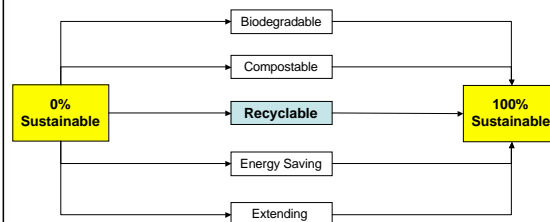
## Sustainability Conclusions >

- **There are presently corrugated solutions that:**
  - Are more sustainable and that are biodegradable and compostable.
  - Extend the amount of renewable sources through performance optimization.
  - Increase the amount of packaging that can be recycled.

## Repulpability: An Important Route to Sustainability >

- Repulping and recycling corrugated materials and structures is a key route to sustainability
- Corrugated structures and materials are recyclable when made without chemical treatments such as wet strength additives, wax coatings, and traditional water repellants
- Demonstrated capability for multiple turns

## What Sustainability Is >



## Voluntary Standard >

- Voluntary Standard for Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor
- Developed by a joint committee of the Fibre Box Association and the American Forest & Paper Association

## Voluntary Standard >

- Screening method for repulpability and recyclability of treated corrugated products
- Two Primary Requirements
  - *Repulpability (Part A)*
  - *Recyclability (Part B)*
- Compliance via a certified laboratory and registration
- Compliant materials can use an enhanced “Corrugated Recycles” logo

## Modified Corrugated Recycles Symbol >



## Repulpability Procedure >

- 100% charge of test material
- Disperse using a modified Waring blender and deflake using a British disintegrator in 125°F water at pH 7
- Test on laboratory screen and determine recovered fiber yield
- Rejects must be less than 15%
- No operational impact or deposition

## British Disintegrator >



## Recyclability Procedure >

- At least 20% treated corrugated along with untreated corrugated is repulped in a laboratory-scale pulper
- Stock is pressure screened
- Either handsheets or paper on pilot machine is made and tested for slide angle, short span compressive strength, bursting strength, and water drop absorption
- Compare with untreated recycled sheets as standard



## Coatings Assessment >

- Testing coated liner as well as treated medium as stand-alone materials
- Exaggerates impact of the coating so that repulpable coated liner or treated medium will be repulpable in the corrugated structure
- Independent of factors that are not coating related

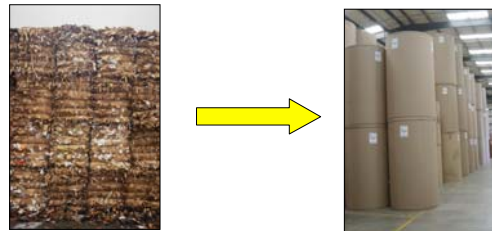
## Experimental Description: Repulpability >

- All testing used 42# liner (except commercial sample)
- Coatings
  - 2 Pass/2 Coating Laboratory Wax Replacement
    - 4 wet lb/msf // 2 wet lb/msf
  - Water shed coating: 2 wet lb/msf
  - Decorative white coating: 5 wet lb/msf
  - Abrasion resistant coating: 2 wet lb/msf
- Commercial wax replacement liner

## Repulpability Results >

- Testing done at Western Michigan University (Certified Testing Laboratory) using the repulpability procedure
- All laboratory samples and the commercial sample passed (>85% fiber yield) and no observed deposition, build-up, or operational impact
- 42# base liner passed (>85% fiber yield)

## Repulpability Results >



## Repulpability Conclusions >

- Appropriately treated liners are repulpable using this standard
- Provides a quick and reproducible method to screen coatings, additives, and other variables
- Coatings that do not disperse/deflake well will be visible on the screen, giving an additional indicator of potential operational issues

## Conclusions >

- These solutions may of themselves, not be based on 100% renewable or sustainable ingredients.
- Through the use of repulpable and recyclable coatings, the industry continues to evolve to sustainable packaging!

**Thank You!**

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