



RheVision®

# RheVision®

- RheVision®
  - Is our trade name for biocomposite polypropylene.
- What's a Biocomposite ?
  - A biocomposite is a material formed by combining resin and a reinforcement of natural fibers.
- RheVision® Natural Fiber Families
  - Wood Fiber – WP/ WM Series
  - Rice Hulls – RH Series
  - Flax Fiber – FF Series
  - Agave Fiber – AF Series
  - Coconut Fiber – CF Series
- Why did we choose Those Fibers ? Are Others Available ?
  - Availability ready to use
    - Not in a raw state
  - Physical attributes in finished goods
  - Others are on the market , just not suitable for us or offer anything special.

# RheVision<sup>®</sup> - W Series

- **WP – Wood Pine**
  - We purchase pine wood fiber from a processor based in Wisconsin.
  - Soft Wood – Light Color, Stronger Wood Smell
- **WM – Wood Maple**
  - We purchase maple wood fiber from a processor based in Wisconsin, but available from many parts of North America
  - Hard Wood - Darker Color, Softer Wood Smell
- **Reclaimed Wood**
  - No trees are cut down for the purpose of producing our raw material.
  - Wood Shavings – Cabinet production and processed timbers.
  - Shavings are hammer milled
- **W Series Attributes**
  - Stiffness
  - Lower specific gravity than minerals
  - Dimensionally stable
  - Colorable / Unique
  - Excellent chemical and mold resistance
  - Good for mineral filled applications

# RheVision<sup>®</sup> - WP30P233-00 is USDA Bio Preferred

- RheTech is one of the first 100 companies to receive this accreditation, which requires that biobased products be composed entirely or significantly from agricultural ingredients.
- USDA's BioPreferred program was created by the 2002 Farm Bill to increase the purchase and use of biobased products within the Federal government and the commercial market. Congress reauthorized and strengthened the program in the 2008 Farm Bill to further promote the sale of biobased products.



# RheVision<sup>®</sup> - WP30P233-00



# RheVision<sup>®</sup> - WM30P233-00



# RheVision® - W Series Data

| <b>RTI Nomenclature</b> | <b>WP30P233-00</b>                     | <b>WM30P233-00</b>                      | <b>WP30P315-00</b>                           |
|-------------------------|--|---|--|
| Description             | 30% Pine Wood Reinforced Polypropylene | 30% Maple Wood Reinforced Polypropylene | 30% Pine Wood Polyolefin with 15% PC Content |
| Filler Percentage       | 30                                     | 30                                      | 30   |
| Density                 | 1.02                                   | 1.02                                    | 1.02   |
| Tensile Strength - PSI  | 4,060                                  | 4,350                                   | 4,350  |
| Flexural Modulus - PSI  | 405,000                                | 330,000                                 | 380,000                                      |
| Izod Impact Ft/lb. - in | 0.6                                    | 0.9                                     | 1.2  |
| HDT @ 66 psi            | 275                                    | 266                                     | 266  |
| HDT @ 264 psi           | 172                                    | 165                                     | 167  |
| Mold Shrinkage          | 0.007                                  | 0.007                                   | 0.007  |

# RheVision® - RH Series

- RH – Rice Hull
  - We purchase rice hulls from a processor based in Arkansas.
- Food Production By-Product
  - Every grain of rice produced for consumption has a hull or husk
  - Hulls are traditionally burned or land filled
  - Used in animal feed production
  - Hulls are hammer milled
- RH Series Attributes
  - Stiffness
  - Lower specific gravity than minerals
  - Dimensionally stable
  - Low moisture absorption
  - Do not combust . Will smolder to ash but will not ignite.
  - Colorable / Unique – much different than wood
  - Excellent chemical and mold resistance
  - Good for traditional mineral filled applications



# RheVision<sup>®</sup> - RH30P233-00



# RheVision® - RH Series

| RTI Nomenclature         | RH10P385-00   | RH30P233-00                            |
|--------------------------|---|--|
| Description              | 10% Rice Hull Reinforced Polyolefin with 15% PC Content | 30% Rice Hull Reinforced Polypropylene |
| Filler Percentage        | 10  | 30                                     |
| Density                  | 0.94  | 1.03                                   |
| Tensile Strength - PSI   | 2,500   | 3,750                                  |
| Flexural Modulus - PSI   | 135,000   | 275,000                                |
| Izod Impact Ft/ lb. - in | 4.2   | 0.8                                    |
| HDT @ 66 psi             | 205   | 255                                    |
| HDT @ 264 psi            | 135   | 151                                    |
| Mold Shrinkage           | 0.0095  | 0.007                                  |

# RheVision<sup>®</sup> - FF Series

- **FF – Flax Fiber**
  - We purchase flax fiber from a processor based in Western Canada.
- **Food Supplement By-Product**
  - Flax is grown for seed and fiber .
  - We are using the processed stalk.
  - Stalks are traditionally burned by the farmer. If tilled into the soil nitrogen must be replaced.
- **FF Series Attributes**
  - Impact
  - Stiffness
  - Dimensionally stable
  - Low moisture absorption
  - Lower specific gravity than minerals
  - Colorable / Unique – looks like natural wood
  - Excellent chemical and mold resistance
  - Glass fiber replacement

# RheVision® - FF30P233-00



# RheVision® - FF Series

|                          |   |
|--------------------------|---|
| <b>RTI Nomenclature</b>  | <b>FF30P233-00</b>                      |
| Description              | 30% Flax Fiber Reinforced Polypropylene |
| Filler Percentage        | 30                                      |
| Density                  | 1.02                                    |
| Tensile Strength - PSI   | 4,050                                   |
| Flexural Modulus - PSI   | 375,000                                 |
| Izod Impact Ft/ lb. - in | 0.85                                    |
| HDT @ 66 psi             | 280                                     |
| HDT @ 264 psi            | 176                                     |
| Mold Shrinkage           | 0.007                                   |

# RheVision<sup>®</sup> - AF Series

- AF – Agave Fiber
  - We purchase agave fiber from a processor based in Central Mexico.
- Commercial Product Waste
  - Agave is not a cacti but related to the aloe plant.
  - We are using blue agave which is used in the production of tequila.
  - The plant is very fibrous. These fibers are separated and processed into usable lengths.
- AF Series Attributes
  - Impact
  - Stiffness
  - Dimensionally stable
  - Low moisture absorption
  - Lower specific gravity than minerals
  - Unique swirl look
  - Excellent chemical and mold resistance
  - Mineral or glass fiber replacement

# RheVision<sup>®</sup> - AF30P233-00



# RheVision<sup>®</sup> - AF Series Data

| RTI Nomenclature         | AF30P233-00                              |
|--------------------------|--|
| Description              | 30% Agave Fiber Reinforced Polypropylene |
| Filler Percentage        | 30                                       |
| Density                  | 1.01                                     |
| Tensile Strength - PSI   | 4,050                                    |
| Flexural Modulus - PSI   | 280,000                                  |
| Izod Impact Ft/ lb. - in | 1.1                                      |
| HDT @ 66 psi             | 270                                      |
| HDT @ 264 psi            | 174                                      |
| Mold Shrinkage           | .009                                     |



# RheVision<sup>®</sup> - CF Series

- CF – Coconut Fiber
  - We purchase ground coconut shell from a processor based in Southeast Asia.
- Food Production By-Product
  - The shell is left over after all usable products are harvested.
  - The shells are left to degrade or are made into charcoal.
  - Shells are hammer milled to our desired particle size.
- CF Series Attributes
  - Stiffness
  - Dimensionally stable
  - Hardness
  - Odor free
  - Low moisture absorption
  - Lower specific gravity than minerals
  - Colorable - unique speckled look
  - Excellent chemical and mold resistance

# RheVision<sup>®</sup> - CFF30P233-00



# RheVision<sup>®</sup> - CFC30P233-00



# RheVision® - CF Series Data

| <b>RTI Nomenclature</b> | <b>CF10P233-00</b>                         | <b>CF20P233-00</b>                         | <b>CF30P233-00</b>                         |
|-------------------------|--|--|--|
| Description             | 10% Coconut Fiber Reinforced Polypropylene | 20% Coconut Fiber Reinforced Polypropylene | 30% Coconut Fiber Reinforced Polypropylene |
| Filler Percentage       | 10   | 20   | 30   |
| Density                 | .93  | .96  | 1.00                                       |
| Tensile Strength - PSI  | 2,860                                      | 2,940                                      | 3,550                                      |
| Flexural Modulus - PSI  | 127,000                                    | 146,000                                    | 221,000                                    |
| Izod Impact Ft/lb. - in | 4.60                                       | 3.63                                       | 1.19                                       |
| HDT @ 66 psi            | 169 F                                      | 196 F                                      | 256 F                                      |
| Mold Shrinkage          | 0.009                                      | 0.0095                                     | 0.0103                                     |

# RheVision<sup>®</sup> - Core Products

- **RH10P385**
  - High impact compound with 15% PC Content
- **CF10/CF20P233-00**
  - Good impact with good surface hardness
- **AF/CF/FF/RH/WP/WM 30P233**
  - Bread and butter compounded 30% reinforced high impact copolymer.
  - Drop the wand in the box and go !
- **WP30P315**
  - 15% PC content
- **CF/RH/WM/WP 50P200**
  - Concentrate that will be let down by the molder.
  - We have physical properties with :
    - 2 Izod copolymer , no break copolymer, fiberglass reinforced copolymer ( increased tensile ) , 100% post consumer content polyethylene.
      - One pound of the blends we have developed that contain 100% post consumer content polyethylene will contain ( by weight ) the equivalent of 1 milk jug.
- **Other custom formulations are available.**

# RheVision<sup>®</sup> - Targets

- **Competitive Materials**
  - W,RH & CF – Similar physical attributes to talc filled homopolymer.
  - FF – Similar physical attributes to glass filled homopolymer
  - AF – In between
- **Applications**
  - Parcel shelves
  - Plant holder
  - Deck components
  - Substrates – Automotive
  - Pet dishes
  - Bird feeders
  - Think Rigid ... Think Unique.....  
**Think Marketable !**

# Molding

- **Materials are hygroscopic**
  - Gaylord will arrive sealed with nylon zip tie
  - Recommend drying at 180 for 2 -3 hours
- **Materials are medium melt flow**
  - The nature of natural fibers does not give a true reading under typical melt flow conditions.
  - Materials flow better than standard 20% talc filled homopolymer
- **Mold Cool**
  - No Greater than 400 F
    - Natural fibers will burn off.
- **Mold Temperature**
  - Typical warm mold 80 – 100 F
  - Keeps surface resin rich
- **Inject fast with speed**
  - Materials like to whiten if shot too slow
- **Some back pressure is good too much is bad**
  - Can add heat to the product
- **Overall SHORTER cycle times because lower temperatures are used.**

# RheVision<sup>®</sup> - Future

- Other Processes
  - Sheet Extrusion
    - RV Flooring
    - Table tops
    - Product for consumers to figure out what to do with !
  - Thermoformed
    - Natural extension from sheet extrusion
- Other Markets
  - UV stability
  - Flame retardant
- Other Combinations
  - Co Reinforced
- What does the market need ?!?