Wrapping an Eco-Friendly World™

Humanitarian Scientific, LLC

HumEco-Tec™: Technology for Sustainable Packaging Design

April 2016

Confidential and Proprietary

Sustainable Packaging Market

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- The Global Market for sustainable packaging is forecast to reach $244 billion by 2018
- The most common sustainable packaging trends are:
  - Increased recycling and waste recovery
  - Increased use of recycled content
  - Increased use of renewably sourced materials
  - Increased use of biodegradable packaging, the latest step in sustainable packaging design

What Do Consumers Want

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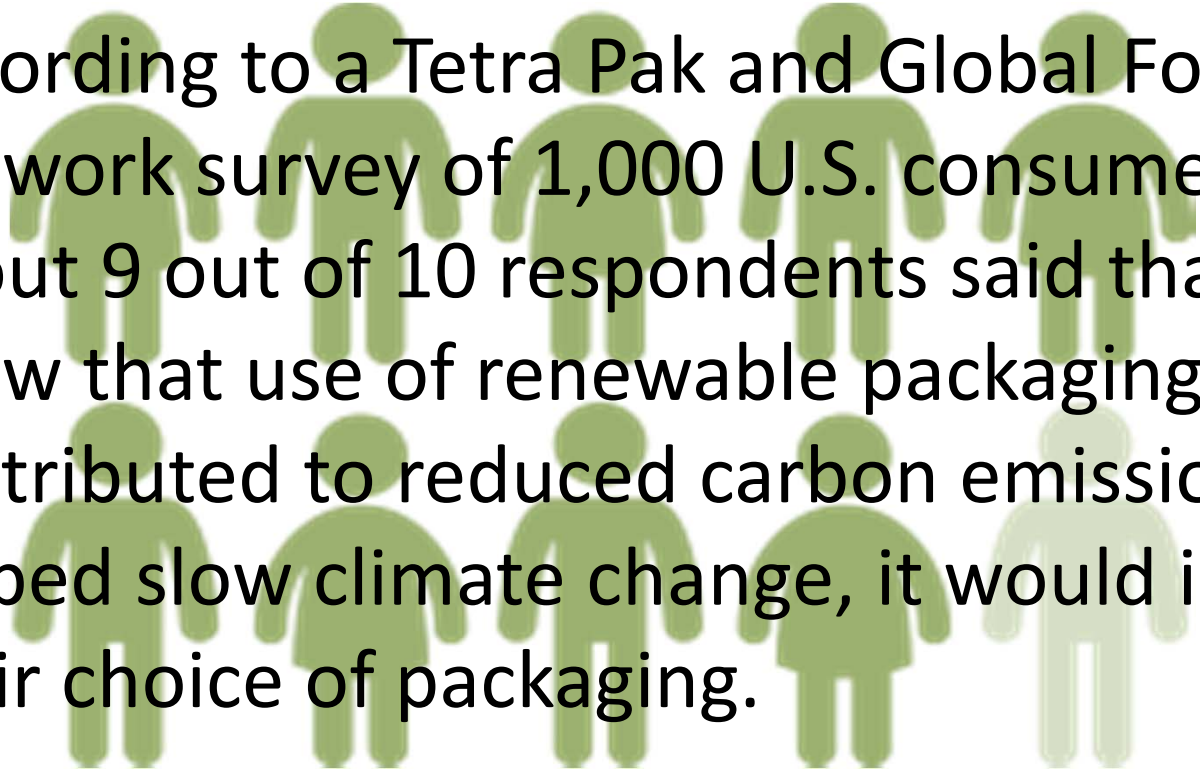

- According to a Tetra Pak and Global Footprint Network survey of 1,000 U.S. consumers about 9 out of 10 respondents said that if they knew that use of renewable packaging contributed to reduced carbon emissions and helped slow climate change, it would impact their choice of packaging.

Biodegradable Packaging

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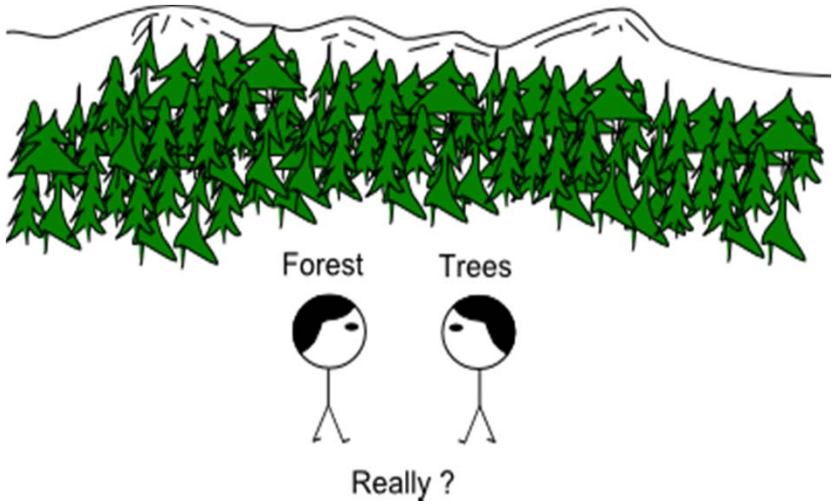
- A search of a patent data base for 2015 alone will result in a number of patents/applications with claims directed to biodegradable packaging (>100).
- However, many of these innovations use a synthetic polymer as raw material, such as polylactic acid (PLA), and hybrids, including silicon.
- But, why use synthetic raw materials? Or inorganics?



Why not use **Cellulose**?

Biodegradable Packaging

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- Cellulosic materials are known for their:
  - High thermal stability
  - Good oxygen barrier function
  - Chemical/mechanical resilience
  - Full degradability in the environment
  - Non-toxicity

Cellulose and its derivatives are therefore the material of choice for environmentally friendly solutions in applications such as packaging for foodstuffs and disposable goods.

Biodegradable Packaging

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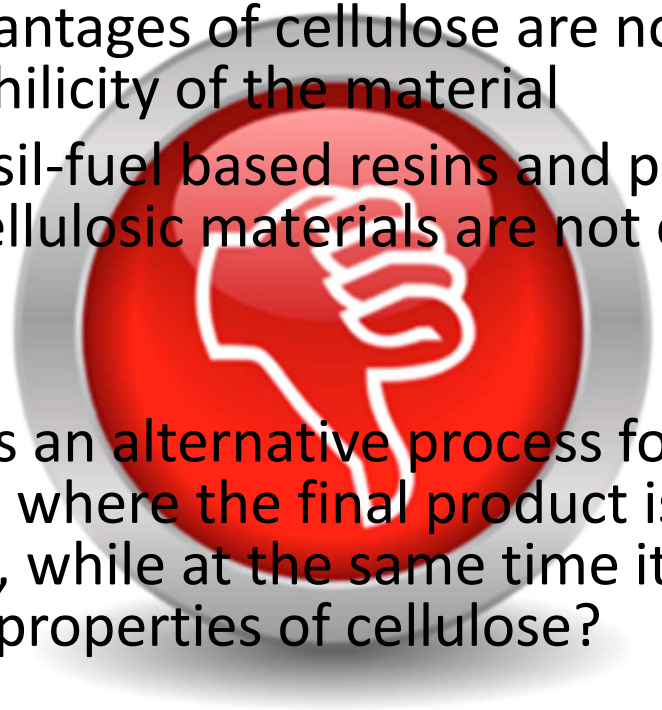
- The many advantages of cellulose are nonetheless countered by the hydrophilicity of the material
- The use of fossil-fuel based resins and polymers (plastics) as coatings for cellulosic materials are not environmentally friendly



What if there was an alternative process for modifying cellulosic-based packaging, where the final product is **both** heat resistant and hydrophobic, while at the same time it maintains the biodegradability properties of cellulose?

HUMECO-TEC™

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- Process

Solid Cellulosic Surface

↓

R-CO-X + Base + Solvent

↓

Heat

↓

Rinse + Dry

R = an aliphatic hydrocarbon from 10 to 40 carbons

X = a halogen

HUMECO-TEC™

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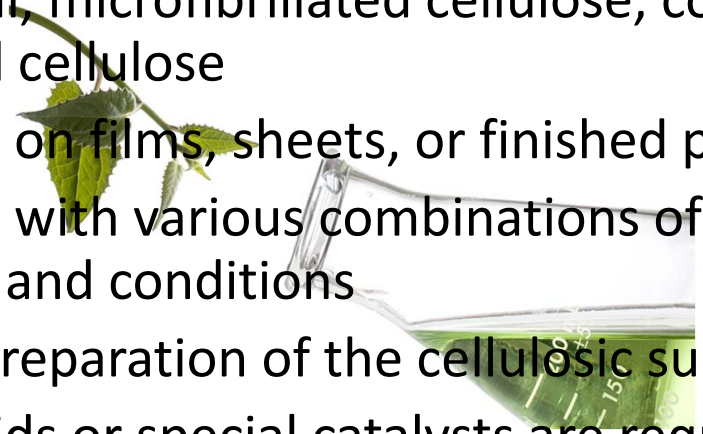
- Process
  - Can be used with nanocellulose, cellulose nanofibres, whiskers or microfibril, microfibrillated cellulose, cotton or cotton blends, or nanofibril cellulose
  - Can be used on films, sheets, or finished products
  - Can be used with various combinations of reagents for tailoring of reactions and conditions
  - No special preparation of the cellulosic surface is necessary
  - No Lewis acids or special catalysts are required
  - Coating may be applied by immersion or spraying



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- Product

Water beading on cellulosic surface treated by HumEco-Tec™

HUMECO-TEC™

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- Product
  - Chemically stable up to 250°C
  - Exhibits a water contact angle of between 100° to 120° (i.e., treated surface is hydrophobic)

HUMECO-TEC™ IP

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- The proprietary HumEco-Tec™ process is disclosed and claimed in U.S. Patent No.9,139,661 and is the subject of applications filed in over 20 countries including EU, CN, BR, JP, KR, IL, MX, CA, ZA, AU, and EC.
- In addition, continuation applications have been filed in the U.S. to capture product claims.

Innventia & External Technology

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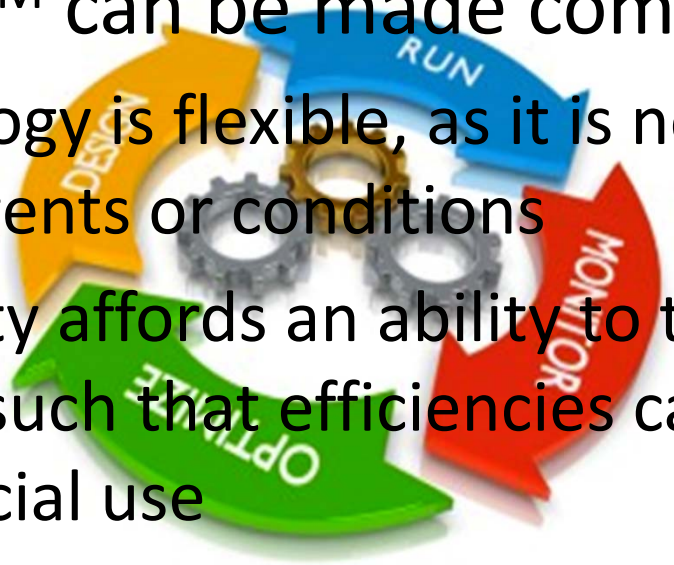
- HumEco-Tec™ can be made competitive
  - The technology is flexible, as it is not limited to specific reagents or conditions
  - This flexibility affords an ability to tailor the technology such that efficiencies can be optimized for commercial use



Humanitarian's Goals

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HumEco-Tec™

- License/Joint Development
- Assignment
- Purchase

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Team

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End

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