Fiberstar Citri-Fi® - Technical Update

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Citrus Fiber and Clean Label

• Citri-Fi, is a citrus fiber made from Pulp, Rag, Core & Peel and is used as a clean label ingredient option.
  • Clean label is a lifestyle change that is not going away
  • Social media, consumer advocacy groups and the internet influence consumers’ perceptions about food and beverages
  • Consumers are more aware today about what is used in their foods
  • People prefer to eat foods containing ingredients that are familiar or found in “grandmother’s pantry”
Product Development Background

• Fiberstar and the Citri-Fi technology started 16 years ago
• Work done at the University of Minnesota and development assisted by Dr. Brock Lundberg
• Citri-Fi commercialized in 2004 and is made using a patented process which increases the surface area of the citrus fiber
• Fiberstar’s citrus fiber is a natural, sustainable, non-GMO and non-allergenic/gluten-free ingredient that is used to replace synthetic and chemical-based ingredients
About the Fiberstar Company

• A privately owned biotechnology Company that manufactures and sells natural and clean ingredient solutions globally to improve quality, health and costs in food, beverage, pet, personal care and industrial markets for over 15 years

• Headquarters located in River Falls, Wisconsin and Fiberstar’s citrus fiber operations include:
  • Main product manufacturing in Clewiston, Florida
    • Located at Southern Gardens citrus processing facility
  • Main Milling, Quality Control and Packaging in River Falls, WI.
About the Fiberstar Company

• Owns and/or licenses over 19 issued patents with 14 pending

• Currently there are five product lines 100, 125, 150, 200, and 300 which provide various beneficial functionalities depending on the targeted applications

• Products are made from citrus pulp, rag, core, and citrus peel
  • Currently oranges (all varieties) and lemons.
Citrus Fiber as a Potential New Revenue Source

Citrus byproducts traditionally can be separated to provide multiple revenue streams including:

- Essentials oils & flavors
- Dried citrus pulp pellets for animal feed
- Undried peel for cattle feed
- Limonene
- Pulp wash
- Pectin peel
- Premium pulp cells
- **Dried Citrus Fiber (Citri-Fi)**
Dried Citrus Fiber from Pulp or Peel

- A new opportunity for traditional byproduct streams is dried citrus fiber
  - Can be used as an alternative to synthetic or unnatural food and beverage ingredients

Citri-Fi is Commonly Used to Replace/Reduce Negatively Perceived Ingredients Below:

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>Meats</th>
<th>Bakery</th>
<th>Dairy</th>
<th>Sauces/Spreads</th>
<th>Beverages</th>
<th>Plating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starches/Maltodextrin</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Gums</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Carrageenan</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Pectin</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Allergens (e.g. wheat, gluten, egg)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Hydrogenated Fats</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phosphates</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Stabilizers/Emulsifiers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Citri-Fi Manufacturing Process

CITRI-FI® PATENTED PROCESS

Citrus farmers sell to juice processors who produce juice products. Byproduct is sent to channels to create value-added products such as citrus fiber.

The fibrous cell wall material is turned into Citri-Fi citrus fiber by using a patented physical process to create a free flowing powder.

Fruit juice is produced and sold into consumer markets.

The process loosens and opens the tightly bound soluble and insoluble fibers and proteins to create an expanded fiber matrix.

FIBERSTAR®
Enhancing Products...Naturally
Very High Water Holding Capacity
With Excellent Stability

<table>
<thead>
<tr>
<th>Various Fibers</th>
<th>WHC (ml/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citri-Fi 200*</td>
<td>13.35</td>
</tr>
<tr>
<td>Citri-Fi 100*</td>
<td>9.95</td>
</tr>
<tr>
<td>Carrot Fiber</td>
<td>6.56</td>
</tr>
<tr>
<td>Orange Fiber</td>
<td>5.02</td>
</tr>
<tr>
<td>Wheat Fiber 200</td>
<td>4.69</td>
</tr>
<tr>
<td>Cottonseed Fiber</td>
<td>3.13</td>
</tr>
<tr>
<td>Tomato Fiber</td>
<td>2.98</td>
</tr>
<tr>
<td>Cellulose, 30 micron</td>
<td>2.78</td>
</tr>
<tr>
<td>Beet Fiber</td>
<td>2.68</td>
</tr>
<tr>
<td>Wheat Fiber 600-30</td>
<td>2.65</td>
</tr>
<tr>
<td>Soy Fiber</td>
<td>2.48</td>
</tr>
<tr>
<td>Oat Fiber</td>
<td>2.32</td>
</tr>
</tbody>
</table>

AACC Standard Method #56-30

Citri-Fi with NO water separation in yogurt

Pectin with water separation in yogurt
Natural Emulsification Properties

*Citri-Fi’s high surface area traps oil and water to create a stable emulsion*
Gelling Functionality

The Citri-Fi product contains ~40% natural pectin which is activated to produce the gelation.

Typical Analytical Results

<table>
<thead>
<tr>
<th>Citri-Fi 100</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (N x 6.25)</td>
<td>7.0 %</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>83.4 %</td>
</tr>
<tr>
<td>of which Sugar</td>
<td>7.2 %</td>
</tr>
<tr>
<td>Dietary Fibre</td>
<td>76.1 %</td>
</tr>
<tr>
<td>of which Soluble</td>
<td>34.7 %</td>
</tr>
<tr>
<td>of which Insoluble</td>
<td>41.4 %</td>
</tr>
<tr>
<td>Fat</td>
<td>0.77 %</td>
</tr>
<tr>
<td>Moisture</td>
<td>5.85 %</td>
</tr>
<tr>
<td>Minerals</td>
<td>3.06 %</td>
</tr>
</tbody>
</table>

Before Processing

- pH 3.7
- pH 3.5

After Processing

- pH 3.3
- pH 3.2
Clean Label Plating Technology

- Citrus fibers can bind oils 15 to 30% by weight and remain a dry powder
- Good for plating of flavors, seasonings, aromatic oils

Citrus Fiber Loaded with Lemon Essential Oil (5 fold)
- Great for instant dry mixes (lemonade in this case)
- Oils are instantly emulsified upon hydration
- Nice flavor release
Food Applications

**Baked Goods:** moisture retention, improved quality over shelf-life, gluten-free formulating, egg extension, fat reduction, caloric reduction, pectin extension in bakery fillings

**Meat & Poultry:** increased yields, reduced purge, juicy and firm texture

**Beverages:** pulp extension, texture improvement, clouding, functional plating for oil-based ingredients

**Dressings & Sauces:** tomato extension, texture improvement, stability in low pH, heat, shear, reduced syneresis, pectin extension

**Dairy:** dairy extension, texture improvement, reduced syneresis, pectin extension in fruit prep yogurt

**Pet Food & Treats:** strengthening, binding, moisture retention, reduced stickiness, texturizer, reduced crumbling, improved flowability
Bakery Benefits

- Regular & Gluten-free Breads
  - Moisture retention
  - Maintained soft quality over time
  - Egg & fat reduction
- Emulsifier Replacement
- Sweet Baked Goods
  - Moisture retention
  - Reduced fat or egg
- Bakery Fruit Fillings
  - Pectin extension
  - Reduced blow-outs
  - Gelling
Meat, Poultry & Seafood Benefits

- Injection/Marinades
  - Phosphate replacement
  - Yield improvement
  - Reduced purge

- Ground Meats
  - Yield
  - Juicy texture
  - Emulsification

- Vegetarian Meats
  - Firm & juicy texture
  - Tenderness
  - Freeze thaw
Beverages Benefits

- **Juices (RTD & Powder)**
  - Improved mouthfeel
  - Pulp extension
  - Gum replacement

- **Smoothies**
  - Thickness
  - Improved texture
  - Stability

- **Milk Drinks (e.g. plant-based)**
  - Body
  - Mouthfeel
  - Stabilization
Dressing & Sauces Benefits

- Pulpy Sauces
  - Tomato/pepper extension
  - Reduced syneresis
- Dressings
  - Cold hydration
  - Emulsification
- Sauces
  - Syneresis control
  - Emulsion stability
  - Freeze thaw
Dairy Benefits

- Yogurts
  - Thickness and body
  - Reduced syneresis
  - Pectin extension in fruit preparation
  - Replace gums or emulsifiers

- Ice Cream
  - Reduced ice crystallization
  - Emulsifier replacement

- Creams
  - Reduced syneresis
  - Dairy extension
Pet Food/Treats Benefits

- Biscuits
  - Strengthening
  - Binding
  - Reduced crumbling
- Semi-Moisture Foods
  - Homogeneity
  - Texturizing
  - Moisture retention
- Injection Molded
  - Improved flowability
  - Texturizing
  - Strengthening - chew time
Additional Future Citrus Fiber Projects
Citri-Fi 125 Student Innovation Contest

- Launched student innovation contest for the past two years
- Provided students experience in solving real world issues in various industries
- Over 50 submissions provided the company new food, beverage and industrial applications using citrus fiber to research and commercialize
Fiberstar’s business initiatives supports the citrus industry by:

- Continuing to invest in developing in new technologies and application uses for citrus pulp and peel
- Educating the markets about the benefits of using various citrus pulp and peel fibers to naturally improve products texture, nutrition and/or cost profile.
Questions