Green Chemistry by Design

Expanding Oleochemical Production of Renewable Chemicals

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Verdezyne Technology Platform

Feedstock Strategy
- Vegetable oils
- Soapstocks and distillates
- Other palm co-products (i.e. PKO, PFAD)

Proprietary Technology
- Organisms engineered for yield and selectivity
- Fermentation-based production

Chemical Intermediates
- Diacids used in fibers, polymers and coatings
- Other organic acids
- Acrylic intermediates
- Diamines

End-Products
- Nylon and polyesters
- Fibers
- Polyurethanes
- Engineered Plastics
- Resins
- Lubricants
- Coatings
- Adhesives
- Corrosion Inhibitors
- Transparent Thermoplastics

Total $70B+ Market

Using fatty acids from any source to produce chemicals
Robust yeast platform using industrial fermentation methods
Total $1.5T+ Market

Engineering Organisms & Processes for Cost-effective Renewable Chemicals
Expanding the Oleochemical Value Chain

Crude Vegetable Oils

Standard Conversions

- Edible Oils
- Oleochemicals
  - Fatty acids
  - Fatty alcohols
- Biodiesel

Verdezyne Technology

Crude Oil & Natural Gas

Petrochemical Refining

- Petrochemical Intermediates
  - Adipic Acid
  - Sebacic Acid
  - DDDA
Cost Advantaged Feedstock Strategy

• Feedstock used by organism to reproduce, for energy and to produce target chemical

• Cost can make up 50% to 80% of total cash cost to manufacture

• Fatty acid based production advantaged over incumbent petrochemical production in both cost and volatility

<table>
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<tr>
<th>Oil Type</th>
<th>Asia</th>
<th>Europe</th>
<th>Americas</th>
<th>Other</th>
<th>World Total</th>
<th>Distillates</th>
<th>PKO</th>
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<tbody>
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<td>Soybean</td>
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<td>Rapeseed/Canola</td>
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<td>19.8</td>
<td>6.3</td>
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<td>61.2</td>
<td>26.1</td>
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<td>10.9</td>
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Est. By-products

By-products/co-products

• Verdezyne’s preferred feedstocks
• Distillates and fatty acids
• Produced in refining and fractionation process
Yeast Production Platform

- Robust under industrial processing conditions
  - Uses inexpensive feedstocks
  - Produces multiple products
  - Fermentation at acidic pH
  - Phage resistant
- Tolerant to saturating product concentrations
- Host genome sequence and advanced genetic toolbox allows rapid development for new products

Superior Host for the Production of Renewable Chemicals
Gen 1 Conversion
- Purified fatty acid feedstock
- Product length determined by feedstock

Gen 2 Conversion
- Mixed fatty acid feedstock
- Product length determined by pathway engineering
Adipic Acid

- **Market size** = $6 B
- Fermentation performed at 400L scale with canola soapstock, FAME, and PFAD
- Validated applications: Nylon 6,6 fiber, PBAT, rigid polyester foam
Dodecanedioic Acid

- Market size = $300 M
- Fermentation process performed at 400 L scale
- Renewable feedstock
- Cost-advantaged process
- Final product exceeds all industry specifications
Example of a Diacid/Fatty Acid Bio-refinery

- Palm Kernel Oil: 50,000 MT
- Value: 1x

C12 ester: 26,000 MT
- C10 ester: 1,600 MT
- Sebacic Acid: 1,600 MT
- Dodecanedioic Acid: 13,500 MT
- Adipic Acid: 11,800 MT
- C8 Fatty Acid: 1,500 MT
- C14 Fatty Acid: 7,700 MT
- Glycerine: 6,600 MT
- Value: >3x

C16-18 Fatty Acid: 13,500 MT
- Gen 1
- Gen 2

Media Components
Potential Synergies with Oleochemical Industry Players

Oleo Company

- Feedstock Supply: Available feedstocks and processing co-products
- Feedstock Processing: Fractionation and esterification capabilities
- Fermentation: Engineered organisms, fermentation technology and design package for plant
- Separation Purification: Validated processes to produce industry grade purity
- Market Development: Existing portfolio of oleochemical products and customer relationships
- Pipeline of parties interested in renewable nylon and other products
- Sales & Logistics: Existing supply chain infrastructure
- New Products: Novel raw materials
- Existing supply chain infrastructure
- Flexible technology platform and world class development team

Verdezyne Partnership

- Optimal usage of assets and operations
- Unique portfolio of renewable and competitive products
- Multiplier effect on value of raw materials to higher value chemicals
- The World Leader in Renewable Chemicals