Pioneering CLEAN solutions from our planet, for our planet.

Verdezyne Innovations for the Coming Decade

E. William Radany, PhD
President and CEO

BioMalaysia ASEAN Bioeconomy 2015
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Fermentation-based Technology Platform

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

**Proprietary Technology**
- Organisms engineered for yield and selectivity
- Fermentation-based production
- Highest quality products

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

**End-Products**
- Nylon and polyesters
- Fibers
- Polyurethanes
- Engineered plastics
- Lubricants
- Coatings & adhesives
- Corrosion inhibitors
- Transparent thermoplastics

**Total $70B+ Market**

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*Engineering Organisms & Processes for Cost-effective Renewable Chemicals*

Research programs initiated in cellulosic ethanol and renewable adipic acid.

2010
Proof of concept for adipic acid and DDDA from renewable feedstocks.

Nov. 2011
Verdezyne pilot plant commissioning.

June 2012
World’s first 50% bio-based Nylon 6,6 fiber produced with Verdezyne adipic acid.

2012
Pilot-scale production of adipic acid and DDDA from renewable feedstocks.

Dec. 2012
Cellulosic ethanol technology sold to DuPont Industrial Biosciences.

Nov. 2014
Bio-XCell selected for the location of Verdezyne’s first commercial facility.

Sep. 2013
BioNexus Status.

Jun 2015
BIOLON™ DDDA earns the USDA Certified Biobased Product Label.

Distribution agreement for over 25% of plant capacity signed with Will & Co.

2015
Ground-breaking.

May 2015
Scale-up of DDDA process to 25,000L produces multiple tons.
Integrated Biorefinery of Verdezyne’s Future

Integrated facilities
• Less waste
• Energy efficient
• Maximize value creation

Crude Vegetable Oil

Refrigery

Refined Vegetable Oil

Chemical Conversion, Fractionation

Oleochemicals
• Fatty acids
• Fatty alcohols
• Biodiesel

Biological Conversion

Specialty chemicals
• Chemical intermediates
Feedstock Flexible Processes

Tested feedstocks

- Oleic Acid
- Canola Acidulated Soap Stock
- Canola Soap stock
- VOP Residue
- Residue-P003
- Soap Stock
- Acidulated Soap Stock
- Mixed Fatty Acid
- Soy Fatty Acid
- Corn Oil
- Soy Methyl Ester
- Canola Methyl Ester
- Tallow
- Yellow Grease
- Jatropha Oil
- Acidulated Soy Soap Stock
- Peanut Oil Distillate
- Trap Oil
- Brown Grease
- Fatty Acid Methyl Ester
- PKO
- C16/C18 Fatty Acid Methyl Ester
- Methylated PFAD
- Ethylated PFAD
- Propylated PFAD
- Crude Palm Oil
- Sludge Condensate Oil
- Esterified residue P
- Esterified residue E
- Ethyl stearate
- Tall Oil Fatty Acid
- Methyl Laurate
- Ethyl Laurate
- Lauric Acid
- Methyl Myristate
- Decane
- Dodecane
- Tridecane
- Tetradecane
- Ethyl Decanoate
- Methyl Decanoate
- Waste Sludge Oil
- Corn Oil
- Bleaching Clay Oil
- CNO
- Decanoic acid
- Sludge palm oil
- Linoleic acid
- Fatty acid residue A
- Methyl Pentadecanoate
- PKOFAD

Multiple conversion technologies

- DDDA
- Adipic acid
- Sebacic acid
- C18 diacid
- C8 diacid

Pilot scale production

- DDDA
- Adipic acid
- Sebacic acid
- C18 diacid
- C8 diacid
Providing Markets with Bio-based Alternatives

**Bio-Adipic acid**
- Thermoplastic Polyurethane
- Plasticizers

**Bio-Sebacic acid**
- Polyamide N6,6, N6,10
- Biodegradable Plastics

**Bio-Dodecanedioic acid**
- Polyester Polyol
- Paints/Coatings
- Foams
- Elastic Parts
- Adhesives
- Resins
- Fibers
- Resins
- Parts
- Films
- Biodegradable Plastics
- Ag Covering
- Packaging
- Spray Coatings
- Thermo-Set Articles

**Industrial**
- commercial carpet
- paints
- coatings
- adhesives

**Automotive**
- Seats and dashboards
- Tire cord
- lubricants
- belts and hoses

**Home**
- carpets
- upholstery
- furniture

**Recreation**
- footwear
- apparel
- camping gear

**Personal**
- packaging
- cosmetics
- fragrance
- flavorings
Thank You!

Verdezyne, Inc.
2715 Loker Avenue West
Carlsbad, CA 92010

www.verdezyne.com
760.707.5245