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New Business Ventures

CORBION: THE LACTIC ACID JOURNEY

Succinity Workshop
July 21, 2015
Outline

• Corbion profile
• Lactic acid product and applications
• Growth of lactic acid market
• CASE studies
• Partnerships
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Corbion solutions address megatrends

**Vision**
Inspire a conscious choice for safe, healthy, and convenient solutions made through nature’s processes and renewable resources

**Purpose**
Improve the quality of life for people today and generations to come

**Mission**
Creating value for our customers through our biobased solutions, designed by science, powered by nature, delivered through our dedication.

**Addressing key global trends**
- Population growth
- Food Security
- Resource Depletion

- Revenue (2014) of € 770 M and EBITDA of € 109.6 M
- Employees: 1,885 of which 226 in R&D
- Unique technology platform: fermentation of organic acids
- 11 production facilities across the globe
Corbion profile

- World leader in Biobased Food Ingredients and Biochemicals
- 80 years of experience in the development, production and marketing of natural and biobased chemicals
- Revenue (2014) of € 770.1 M and EBITDA of € 109.6 M
- 1,900 Employees, 200 in R&D
- 11 production facilities across the globe
- Listed at NYSE Euronext Amsterdam: CRBN

Source: Company data
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Lactic acid: 2 stereoisomers

L (+) lactic acid  D (-) lactic acid

Purac® Lactic Acid : Pure L(+) or D(-)
Synthetic LA: 50/50 mixture
Growth drivers for lactic acid market in different phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>Key Products</th>
<th>Key Applications</th>
<th>Functionalities</th>
<th>Market Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Until 1980</td>
<td>Synthetic lactic acid</td>
<td>• Leather Tanning • Metal plating • Textile dyeing</td>
<td>• pH control</td>
<td>Basic functions</td>
</tr>
<tr>
<td>1980-1990</td>
<td>• Natural Lactic acid • Lactate salts</td>
<td>• Food applications</td>
<td>• pH control • Preservation • Fortification • Bio-availability</td>
<td>• Replacement of synthetic by natural L(+) LA • Taste profile</td>
</tr>
<tr>
<td>1990-2000</td>
<td>• Lactate esters • Lactate salts</td>
<td>• Cosmetics • Personal care • Microelectronics • Agro • Detergents • Oil Field • Animal Feed • Bioremediation</td>
<td>• Moisturizing • Safety • Solvency • Adjuvancy • Descaling • Anti-bacterial</td>
<td>• Product Purity • Regulatory for chemicals, solvents, biocides</td>
</tr>
<tr>
<td>2000 onward</td>
<td>• D(-) lactic acid • Lactides</td>
<td>• PLA • Acrylic Acid, PDO • Resins • Chiral synthesis</td>
<td>• Biodegradability • Bio-based • Chirality • Intermediate</td>
<td>• Sustainability • Technology</td>
</tr>
</tbody>
</table>
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Natural lactic acid growth has been driven by continuous innovation.

In each growth phase different trends can be addressed.
Growth driven by added value functionalities and innovation

**Innovation topics:**
- Technology
- New products
- Product purity
- Functionalities
- Applications
- Services
- Partnerships

**External drivers:**
- Safety
- Natural
- Environment
- Regulations
- Sustainability

**Focus shifting from:**
- Value
- Application development
- Functionalities
- Regulations

**To:**
- Volume
- Process development
- Cost
- Sustainability
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CASE 1: Home & Personal Care

Product Portfolio

Home Care and I&I

Product Functionalities

• Antimicrobial
  • *Antivirus*
  • *Antibacterial*
• Descaling
• Soap scum removal
• Solvents
• Buffering

Product Categories

• Surface Care
• Disinfectants
• Laundry Care
• Dishwashing (manual)
• Toilet Care
• Industrial & Institutional

Benefits

• Multifunctional
• Safe
• Biobased
  & readily biodegradable
• Effective
• Easy to formulate

Application development, biocide directive, product registrations were required to address a market need for mild and safe products
Synergy effect of PURAC Sanilac

- Sanilac is one of the few widely available natural anti-microbials. It plays a growing role in the consumer trend for natural biocides. As such it is competing with traditional – chemically based - biocides like Triclosan or Quats.
- Many commonly used detergent ingredients, like surfactants and alcohols strongly enhance Sanilac efficacy by increasing the bacteria membrane permeability.
- As a result when used in combination, Sanilac becomes a very potent bactericidal agent being very effective at low concentrations.
- PURAC Sanilac is listed/supported by a number of Eco label organizations.

Value does not come from “Bio” as such, but of whole product and performance profile.
Product Portfolio

Industrial Applications

Product Functionalities

• Solvency
• Purity (e.g. ppt metals)
• Adjuvancy
• Compatibility / Adhesion
• Wax solubilization
• Chiral purity
• Reactivity

Product Categories

• Photoresists
• Edge bead removal
• Agrochemical formulations
• Chiral synthesis
• CASE resins

Benefits

• Multifunctional
• Safe
• Biobased & readily biodegradable
• Effective / Synergistic
• Registered as Inert

Product specifications, performance and industry requirements (registrations, supply security) have been key to build a sustainable position.
CASE 3: PLA

Next growth phase for lactic acid: PLA
D(-) lactic acid opening up higher value markets

Value & Performance

Ongoing technology development enables high volume applications like PLA
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Partnerships

Partnerships are essential for growth of our businesses:

- Market access and product application expertise
- Key technology platforms
- Captive-use markets

BASF

Succinonic acid

Synbra

SUPLA

Cargill

PLA

Animal Health Solutions
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- Captive-use markets
Corbion fermentation & downstream processing: leverage lactic acid molecules & technology into new business

Lactic acid and lactates
- 80 years experience
- Fermentation
- Downstream processing

L and D-Lactide
Partnership with: SULZER
PLA biodegradable plastics

Succinic acid
Partnership with: BASF

FDCA

Future
Building on Corbion core capabilities
- Fermentation and down-stream processing
- Salt-free production of organic acids
- Alternative feed stocks
Key Success Factors in Lactic acid growth

• **Application development** to identify functionalities in key applications
  - Low taste for preservation
  - High purity solvents for electronics
  - Specific registrations for different application fields
  - Strong value propositions

• **Strong and protected** *Technology*
  - Continuous improvement of manufacturing process
  - Sustainability as driver for improved process with low environmental impact
  - Continuous improvement of technology and product specifications

• **Biobased in itself not the key-driver for growth, but rather** safety, regulatory, functionality and performance

• **Development of** derivative products to broaden addressable market:
  - Solvents for electronics and agro
  - Blends for food
  - Purac Sanilac® for household & personal care
  - D(-) and Lactides for PLA
  - Leveraging capabilities
My lessons learned

- Leverage core competences
- Work with complementary partners with aligned objectives to increase chance of success
- De-risk before going to large scale: demo scale is indispensable
- Apply what you have learned and stay nimble

But most importantly

- Always look at the facts not fiction
- Avoid ‘tunnelvision’ on your technology; it should be ‘best-in-class’ throughout the process
- and .... be patient; development takes time with sometimes unexpected results in a process step
“Designed by Science, Powered by Nature and delivered through dedication”
Hurdles for growth

- Understanding product functionalities
- Understanding competitive product functionalities and draw-backs
- Identifying needs in the market
- Develop value proposition based on market needs
- Understand the ‘culture’ associated with each target segment
- Obtain required registration and regulatory approvals (FIFRA, FDA, etc.)
- Gain understanding on risk vs. reward
- Convincing own organization to allocate resources to new opportunities versus running business
  - New product development
  - Application development
  - Sales organisation
  - Manufacturing
  - Supporting organisation