



# PURAC's Value Proposition for Poly Lactic Acid



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VP Chemical & Pharma

# Personal Introduction: Arno van de Ven



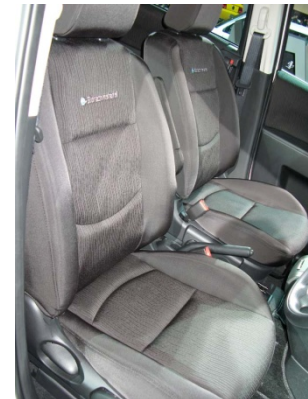
- Education
  - Master in Business Administration (MBA),  
University of Limburg
- Career
  - Philips: International Marketing and Sales Manager Semiconductors
  - More than 15 years experience in specialty plastics and specialty chemicals:
    - DSM: Business Manager Engineering Plastics
    - BF Goodrich/Lubrizol: Vice President Specialty Plastics
    - Ferro Corporation: Vice President Specialty Chemicals
    - PURAC(2006): Vice President Chemical & Pharma

# Agenda

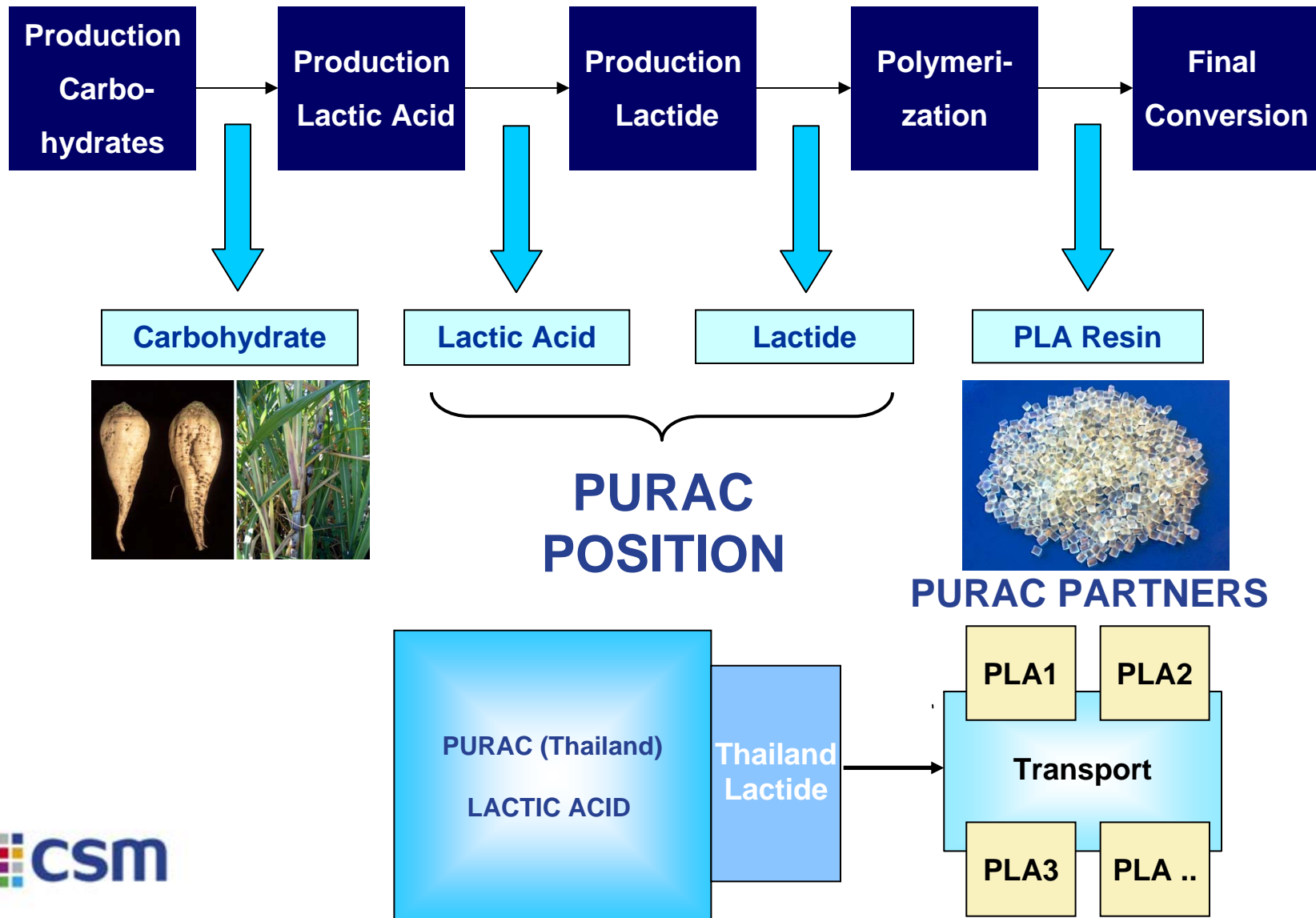
- Market drivers
- PURAC's positioning in the PLA value chain
- 2nd generation PLA
- Succinic Acid

# Drivers for bioplastics

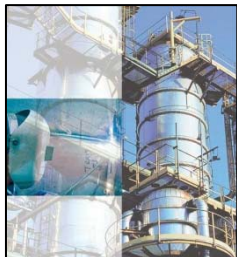
- Consumer demand for “green” products
- Retailers and brand-owners longing for green image
- Reducing CO<sub>2</sub> emissions
- Oil availability limitations
- Positive framework conditions



# Value chain of Poly Lactic Acid

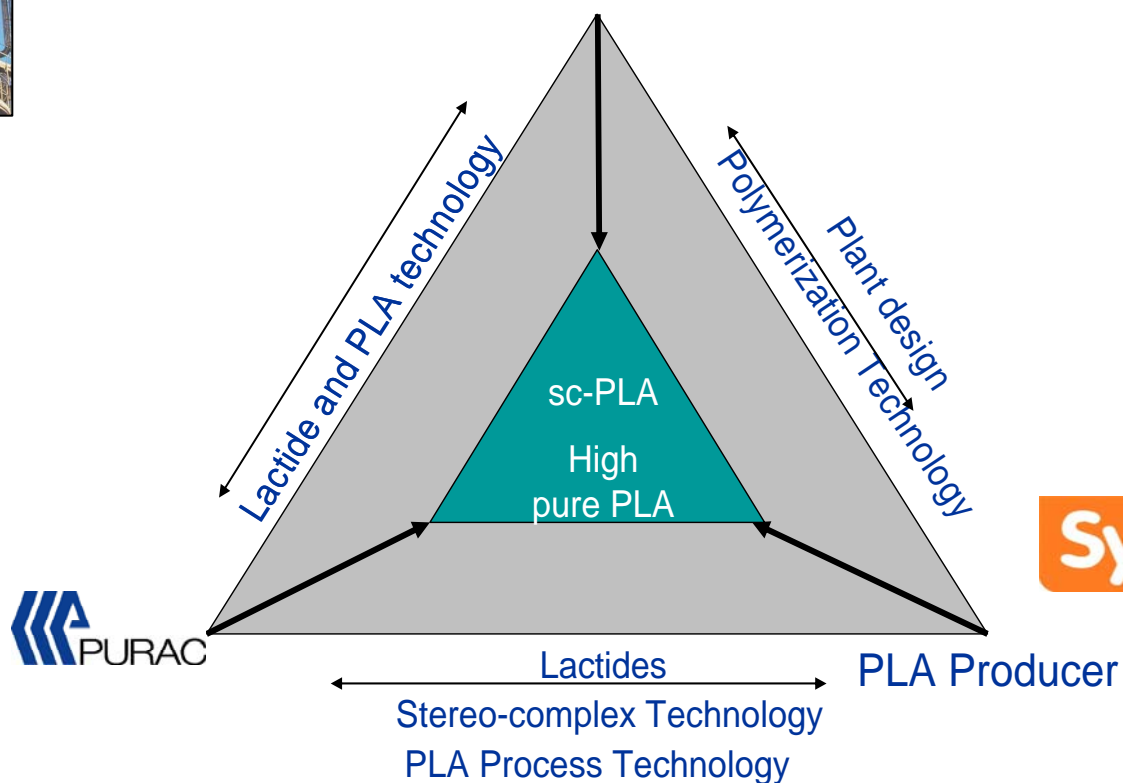


# PURAC's partnership model



**SULZER**

Technology  
Provider

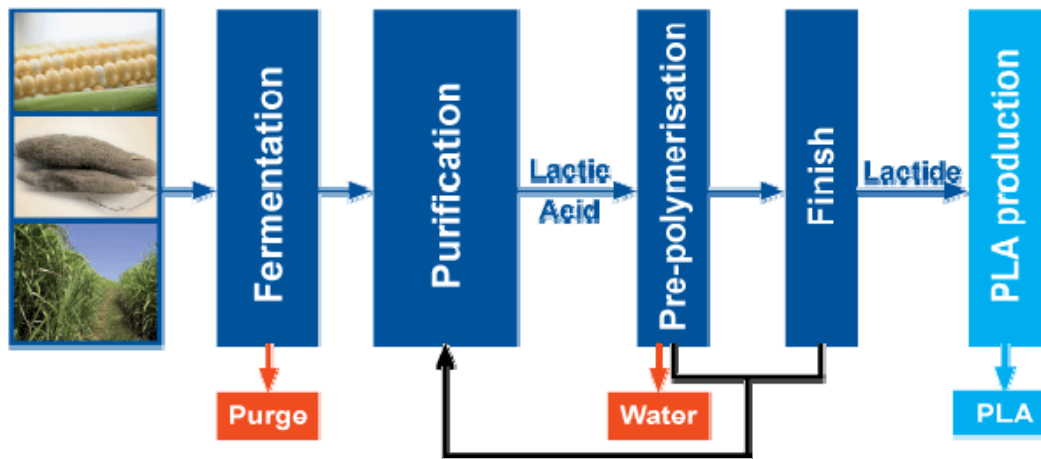


**Synbra**

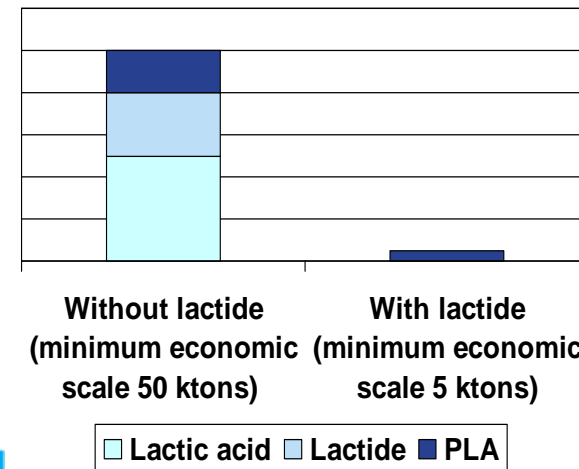


# PURAC reduces entry barriers for PLA producers

	PURAC	PURAC	Partner
Step	Lactic Acid	Lactides	PLA
Investment	50%	30%	20%



Investment hurdle for PLA producer



PURAC is enabling PLA producers by reducing:

- Minimum scale for investment
- Investment hurdle
- Technology hurdle
- Investment risk

# Strengths of PURAC business model

- Polymer/plastics partners
- Business development synergies for partners
- Leveraging PURAC capabilities by collaborating with 10+ partners with complimentary polymer, application and plastics market expertise
- Unique products enabling value-added market growth
- Shortening development timeline for partners
- Synergy between partners
- Lowering investment hurdle and risk

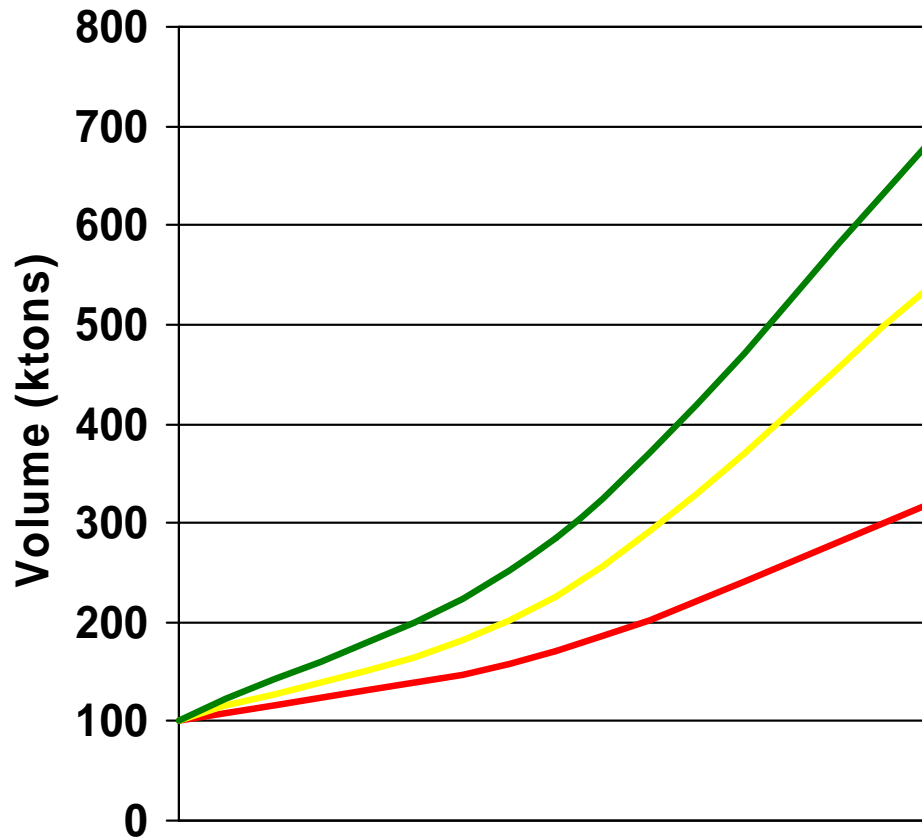
# The D(-) technology upgrades the applications & value perception of PLA

- 1st Generation PLA
  - Heat deflection temperature rather low
  - Sticking of pellets during transport, storage, and processing
  - Distortion during transport and use of trays, pre-forms, cups, etc.
- 2<sup>nd</sup> generation PLA
  - Improved temperature performance
  - Heat resistance up to 180 °C in Heat Deflection Temperature test
  - Control over properties by blending of L and D polymers

# Application milestones for PLA



# PLA market forecast with 'second generation' PLA



## 2<sup>nd</sup> Generation PLA

- High added value

## 1<sup>st</sup> Generation PLA with Lactide

- Removing market hurdles

## 1<sup>st</sup> Generation PLA based on PLLA

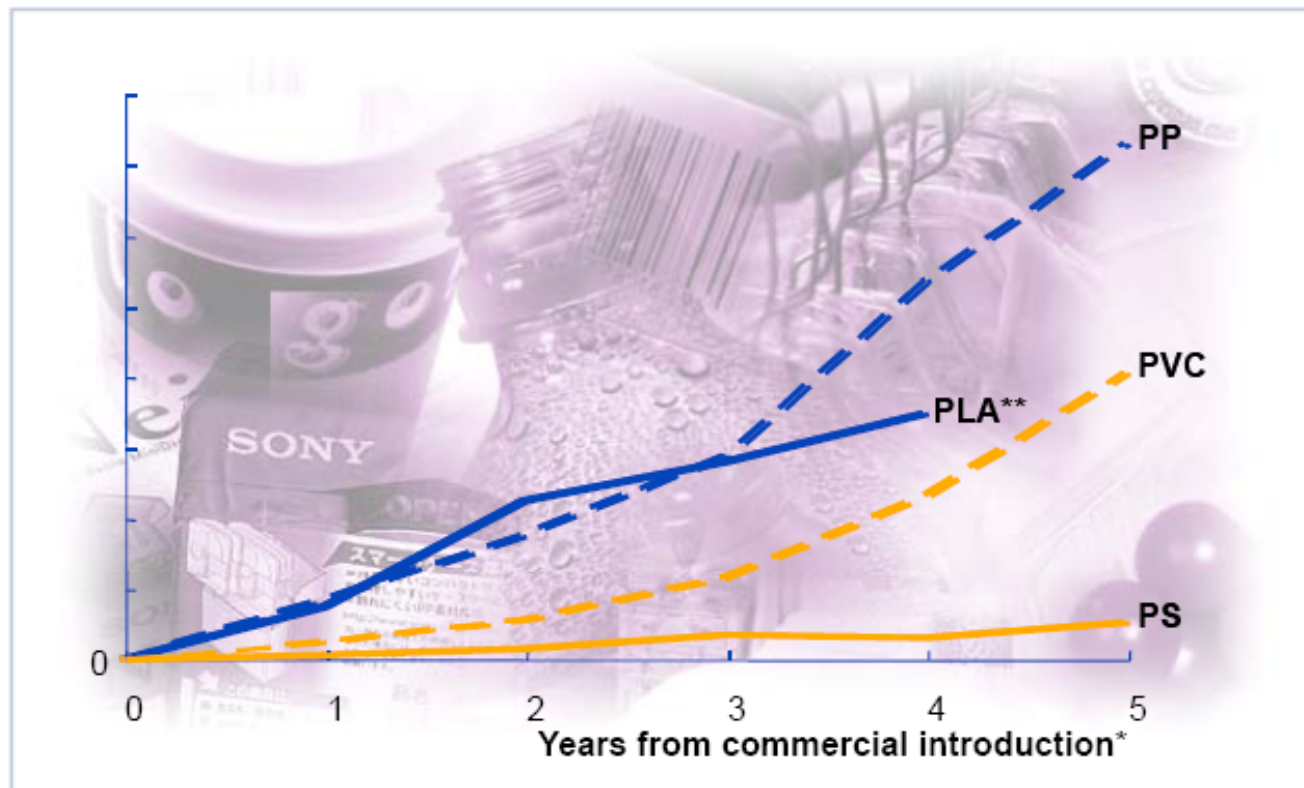
- Low added value applications

# PLA developments versus other plastics

Commercialization of biopolymers appears slow but is in line with previous market entries

PLA vs. OTHER MAJOR PLASTICS

Volumes in first years



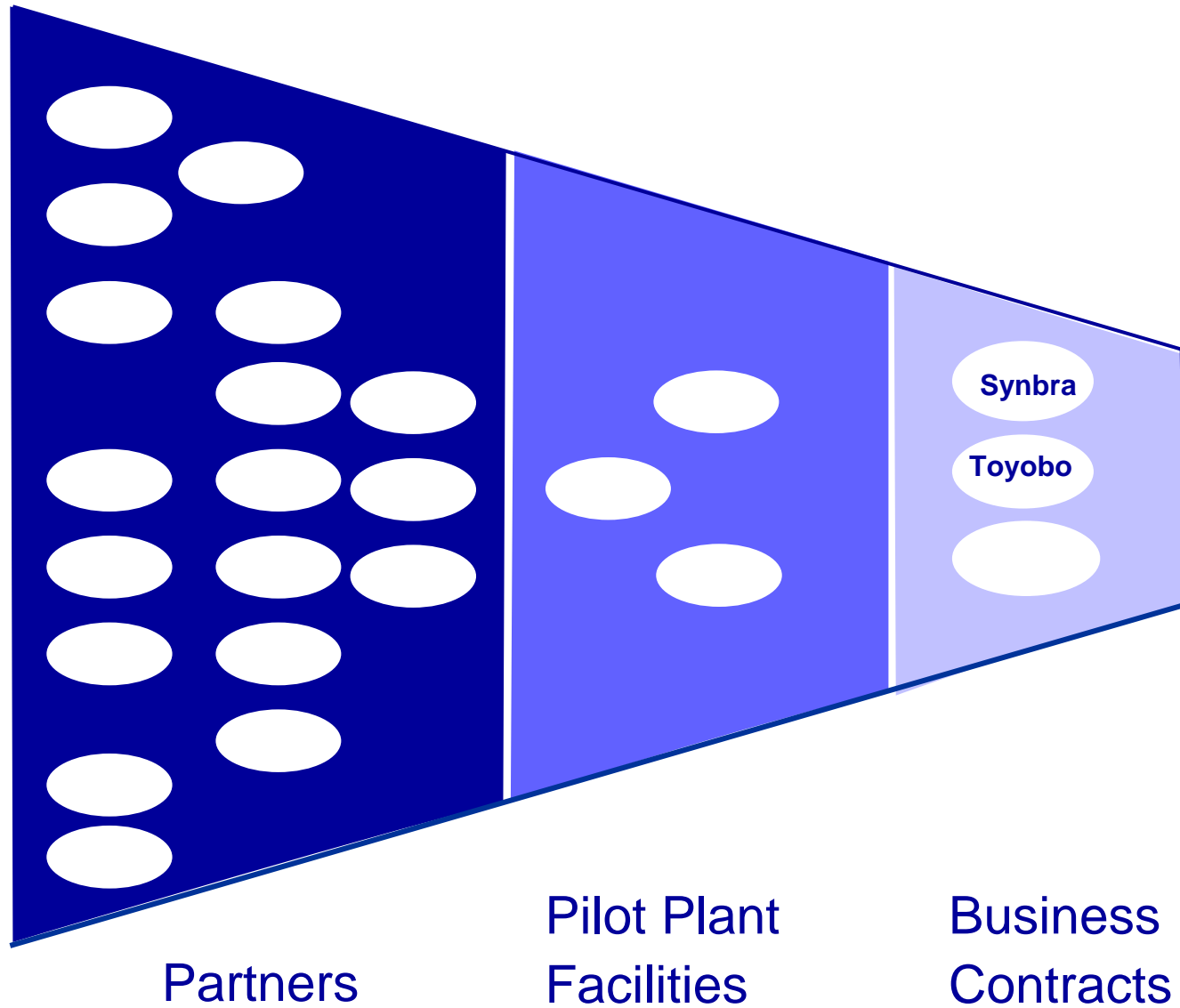
\* Commercial introduction defined as opening date of first commercial plant

\*\* PLA numbers estimated based on best available public sources

Source: Synthetic Organic Chemicals; press releases; Freedonia Group – degradable plastics (2004); SRI Biodegradables report (2004)

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# Bioplastics partner development mid 2009



## PLA program showing substantial progress

- Successful production of L-Lactide at industrial scale in Spain
- Successful production of D-Lactic Acid and D-Lactide at industrial scale in Spain
- New and higher value added applications being developed
- Sulzer PLA process further tested and improved
- Basic engineering for industrial Lactides plant in Thailand completed
  - Ready for the next step
- Increasing number of (potential) business partners



# Succinic Acid



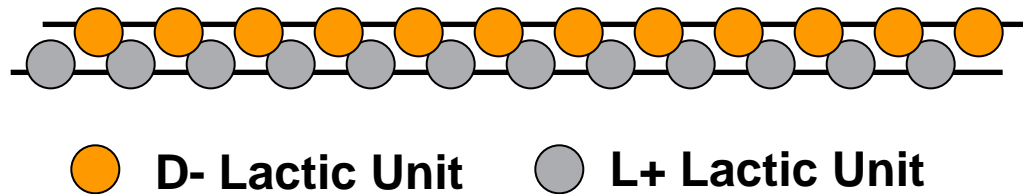
## Partnership with BASF



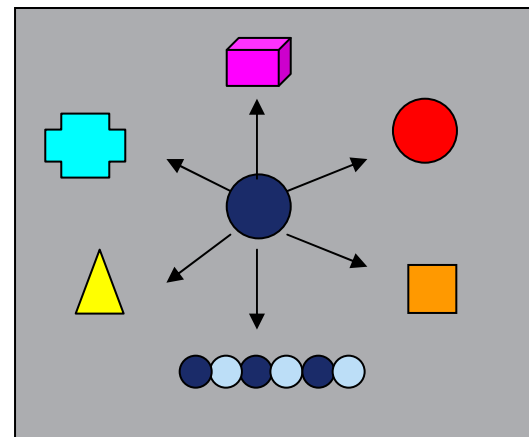
- In September 2009 PURAC and BASF signed an agreement on the development of the production of bio-based Succinic Acid.
- The partnership aims at demonstrating the production of commercial quality and volumes in the second quarter of 2010.

# Succinic Acid versus Lactide

- Lactide = functional building block for PLA based polymers



- Succinic Acid = platform molecule
  - building block for large scale intermediates based on renewable resources



# Application fields of biobased Succinic Acid

**Coolants and  
Deicers**

**Chemical  
Intermediates**

**Fuel Additives**

**Plasticizers**

**Polyamides**

**Biopolymer /  
Polyesters**

**Fine Chemicals**

**Cosmetics /  
Food / Pharma**

**Solvents**

**Polyurethane**

## Positive references for Succinic Acid



United States Department of Agriculture

**“USDA 2008 report “US Bio-based Products” rates Succinic Acid as top value added chemical from biomass feedstock”**

F R O S T & S U L L I V A N

F R O S T & S U L L I V A N

**“Frost & Sullivan 2008 report rates Lactic Acid and Succinic Acid among the top 4 renewable building blocks for chemical industry”**



