PRODIAS
Processing Diluted Aqueous Systems

SPIRE PROJECT

PRODIAS
Developing resource and energy-efficient methods and technologies to boost competitiveness of European Industry

BASF We create chemistry

ALFA LAVAL

GEA

Imperial College London

XENDO SOLUTIONS FOR LIFE SCIENCES

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TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

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PRODIAS
Facts

- **PRODIAS** (**PRO**cessing **D**iluted **A**queous **S**ystems) **fosters** competitiveness of the European process industry
- **PRODIAS** aims to **decrease production costs** for renewable-based products via **increasing the efficiency** of raw material use and production processes

- **PRODIAS: Consortium of nine partners,** funded by European Union with €10 million – total project budget is about €14 million
- **PRODIAS** Start Date 1st of January 2015, Duration 48 Month

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PRODIAS
Challenges & Targets

[The challenge

- Integration of renewable raw material into industrial value chains
- Cost-competitiveness of processes using renewable resources
- Challenging product properties
- Complex, energy intensive downstream processes

[The target

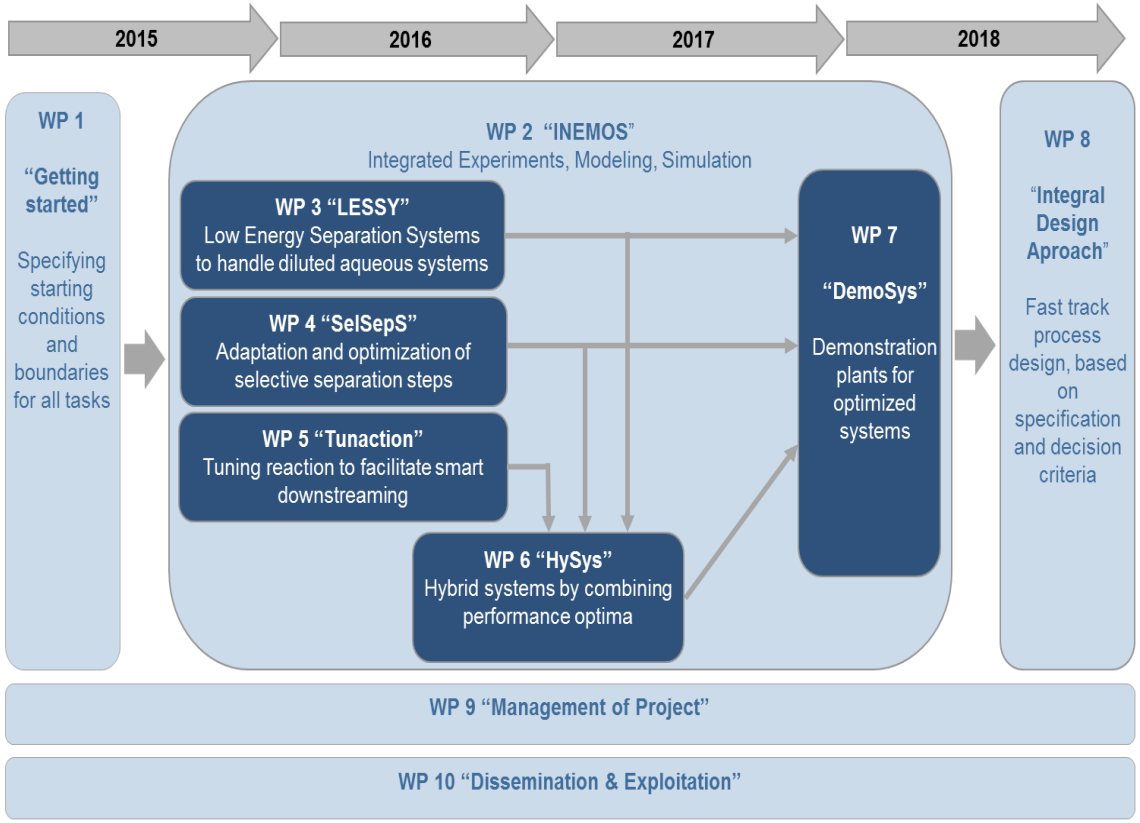
- Substantially improvement of downstream processes
- Decreasing CAPEX via shorter process chains and / or smaller unit sizes
- Decreasing OPEX via increased efficiencies, less energy and utility usage
- Increase of competitiveness of bio-processes and renewable processing

PRODIAS
Concept & Schedule

[The concept

- Development of **optimized and novel**, cost-effective and "renewable-tailored" **concentration and separation technologies**
- Tuning of **up-stream** process
- Development of **hybrid combinations**
- **Demonstration** of technologies in industrially appropriate environments
- Process characterization to identify the key **physical property data** required for the design and operation
- **Integrated design approach** for the fast-track selection

[The schedule



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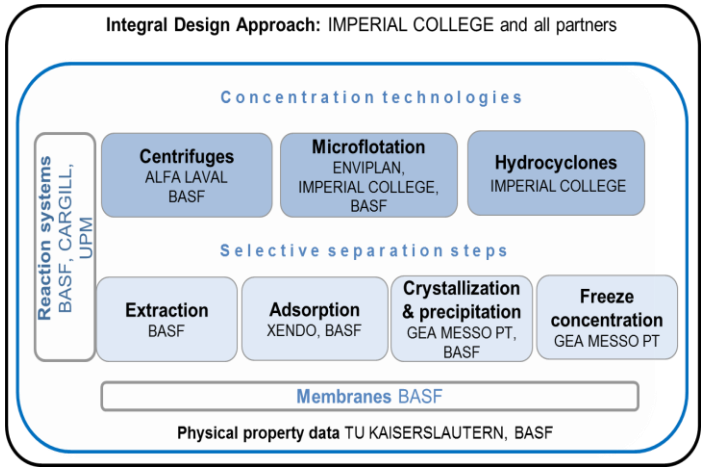
Technologies & expected realizations

[The technologies

- Novel & optimized concentration + separation technologies with improved performance
  - Significant increase in productivity and efficiency
  - Decrease of complexity of processes
  - Significantly lower energy consumptions
  - Decrease of investment costs

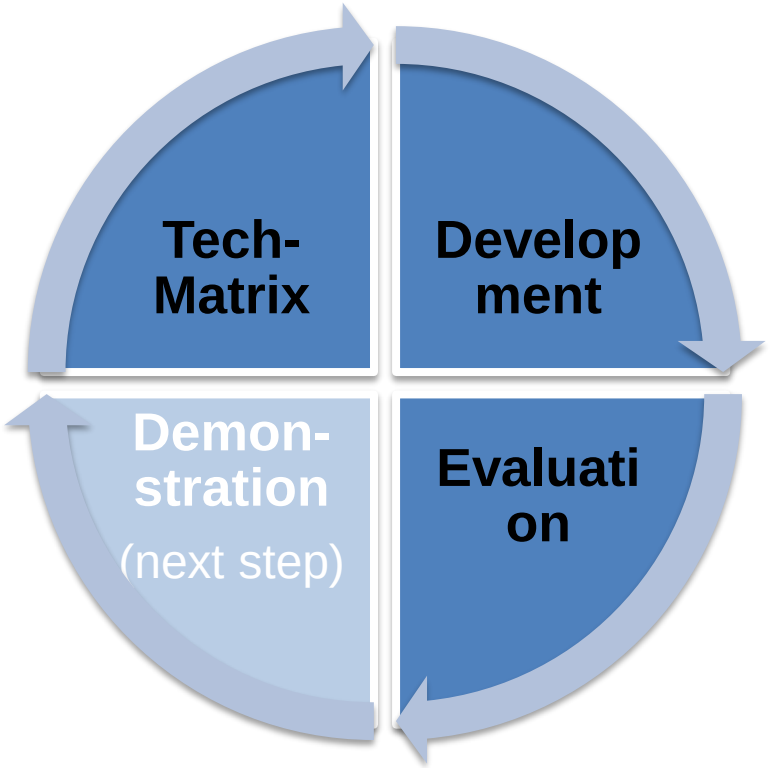


[Expected realizations

- **Demonstration of 2-3 technologies** in pilot plants in industrially appropriate environments **TRL 5-7**
- **6 – 7** implementations of reaction & separation technologies as standards in R&D
- **3** implementations of the design approach

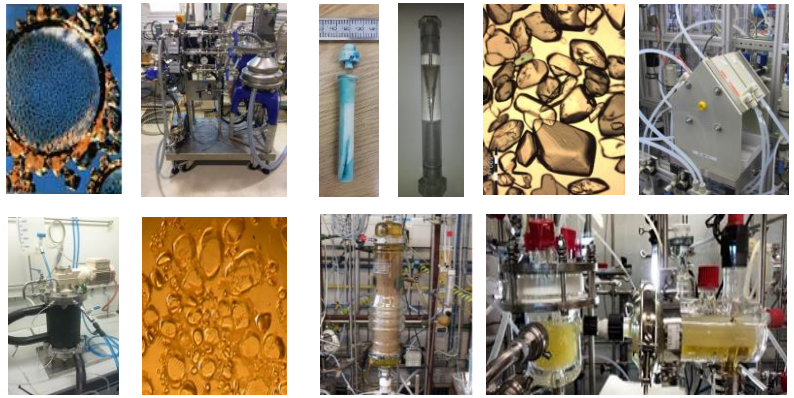
PRODIAS
18 Month Status

(Source: BASF picture database)

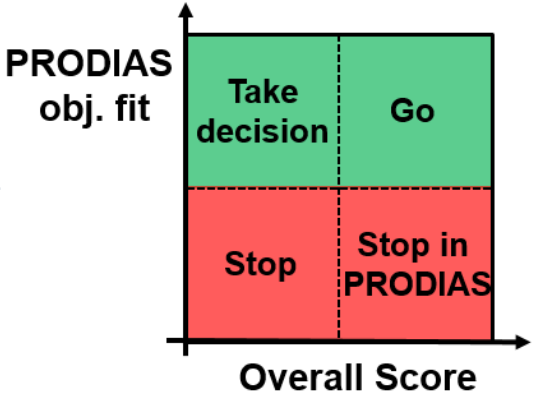


WP3 LESSY
WP4 SELSEPS
WP5 TUNACTION

11 Single Techn.
12 Hybrid Combi.



(Source: PRODIAS Consortium partners)



Technologies developed and optimized in WP3, WP4, WP5

Single Technologies Project Month 18

- Low energy high-speed centrifuges
- In process microflotation
- Small hydro-cyclones for yeast separation
- Screening apparatus for flocculation
- Co-Crystallization to decrease solubility
- Salt-form Crystallization
- High titer product fermentation
- Biomass recycling as active booster for fermentation
- Purifying sugars hydrolysate via adsorption
- Purifying sugars hydrolysate via chromatography
- Crystallization greens recycling

(Source: PRODIAS Consortium partners)

Hybrid Technologies Project Month 18

- Flocculation inside high-speed centrifuges
- Flocculation as preconditioning for high-speed centrifuges
- EBA in SMB-Mode
- In situ batch extraction & recovery
- Reactive extraction & recovery
- Extraction & bipolar ED
- IEX & bipolar ED
- Anti solvent crystallization & SMB
- Combined Cryst. & Dec
- Combined Cryst. & Reflux
- Purifying sugars hydrolysate via flocculation / flotation & membrane
- Freeze concentration & membranes

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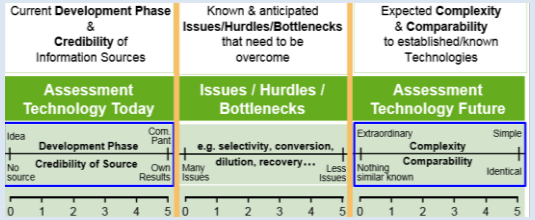
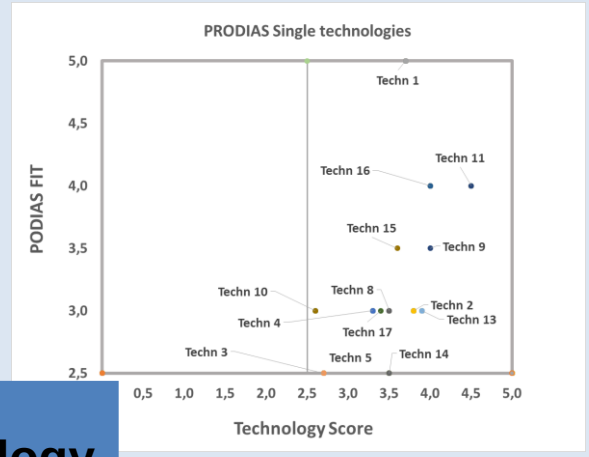
Technology Evaluations towards Demonstration

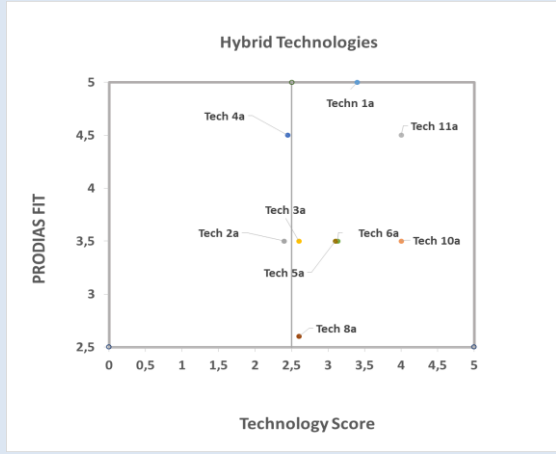
Technology Score Card



Fit to PRODIAS Objectives

Decreased **investment costs**
Increased **raw material efficiency**
Decreased **energy consumption**
leading to e.g. less CO_2 emission

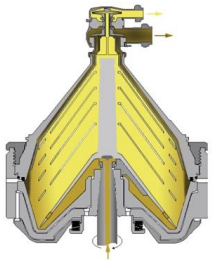




Technology Evaluation

Today three Technologies nominated for
DEMONSTRATION in pilot plants in industrially appropriate environments **TRL5-7**

CENTRIFUGES WP3
- Energy efficient (50% reduction)
- Improved functionality
- Pilot plant separator 2017



HIGH TITER FERMENTATION WP5
- Increase of final titer
- Increased productivity
- Improved raw material efficiency
- Implementation ongoing

FREEZE CONCENTRATION WP4
- Technical feasibility proven
- Quick return on investment
- Savings in OPEX
- Starting construction of commercialized size module 2017

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Impact

[Technological

- **Novel & cost effective separation technologies**
  - Toolbox of validated separation technologies
  - Integrated design approach
- **Improved Performance**
  - Significant increase in productivity and efficiency
  - Decrease of complexity of processes
  - Significantly lower energy consumptions
  - Decrease of investment costs

[Environmental

- Reduction of energy consumption
- Reduction in GHG emissions
- Reduction of water usage
- Increase of raw material efficiency

[Economic/Social

- Stronger Competitiveness of the European Industry
  - Establishes R&D results in near to industrial environment
  - Develops methods and technologies used in different industrial sectors
  - Increase of competitiveness of renewable-based chemical products
  - Offers employment opportunities
- Improved Innovation Capacity and Knowledge Integration
  - Cross sectorial partners share knowledge and costs
  - Deepened understanding of downstream processes via cooperation
  - Acceleration of adaption, transfer and take up of new technologies

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Outlook

[Next steps

- Advanced development phase for technologies for implementation with planned TRL 4 and above

- Specification of starting conditions and boundary conditions towards DEMOSYS (WP7) for technologies TRL5-7

- WP8 (Integral Design Approach) Initiation of information exchange (publication event) and starting workshop on the topic of "Decision support for design of downstream processes“ in Nov 2016

- Next technology review planned for beginning of 2017

- PRODIAS webpage: https://www.spire2030.eu/prodias/

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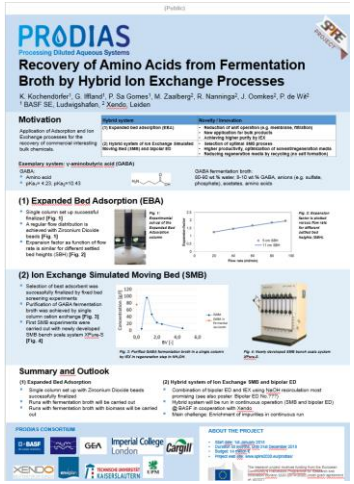
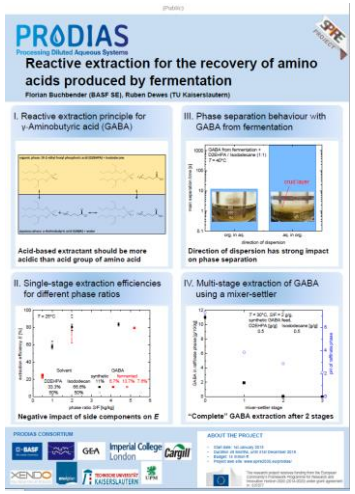
Posters on ProcessNet 2016



BASF / Xendo



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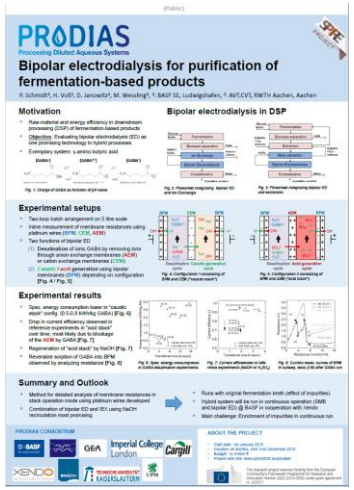

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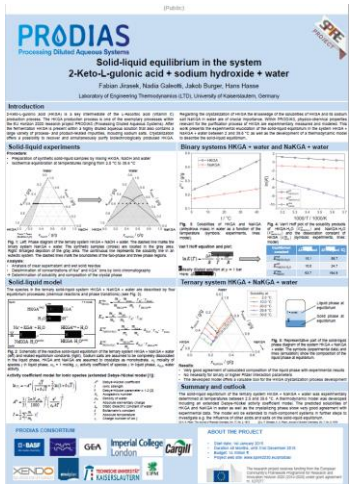
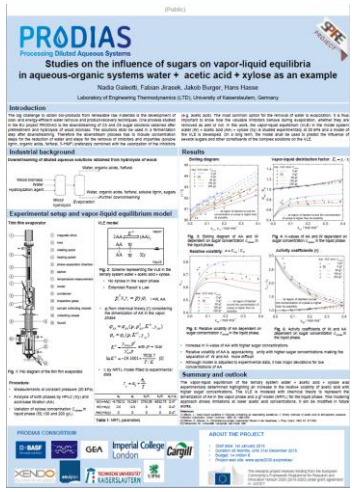


TU Kaiserslautern



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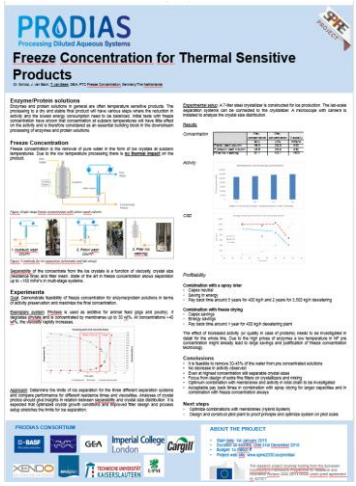
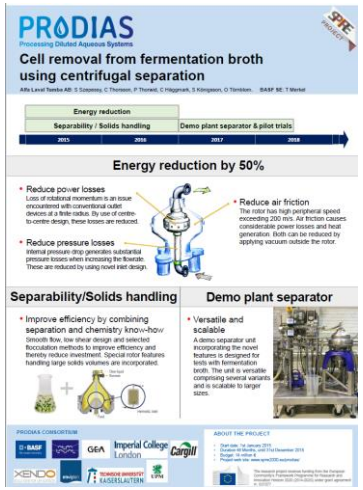


GEA Messo PT



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More Information

- PRODIAS webpage:
  http://spire2030.eu/prodias/

- Framework Horizon2020:
  http://ec.europa.eu/programmes/horizon2020

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