SoliQz

Solutions for high-purity chemicals

Green Chemicals deserve sustainable purification

Perfect pitch and boost the European Bio-economy event,
November 7, 2018, Brussels

Nicolaas Viets,
Athina Pantelidou
SoliQz B.V., Rotterdam,
The Netherlands

viets@soliqz.com

SoliQz B.V. is a Rotterdam, NL based SME providing services and equipment for purification of (bio-based) chemicals

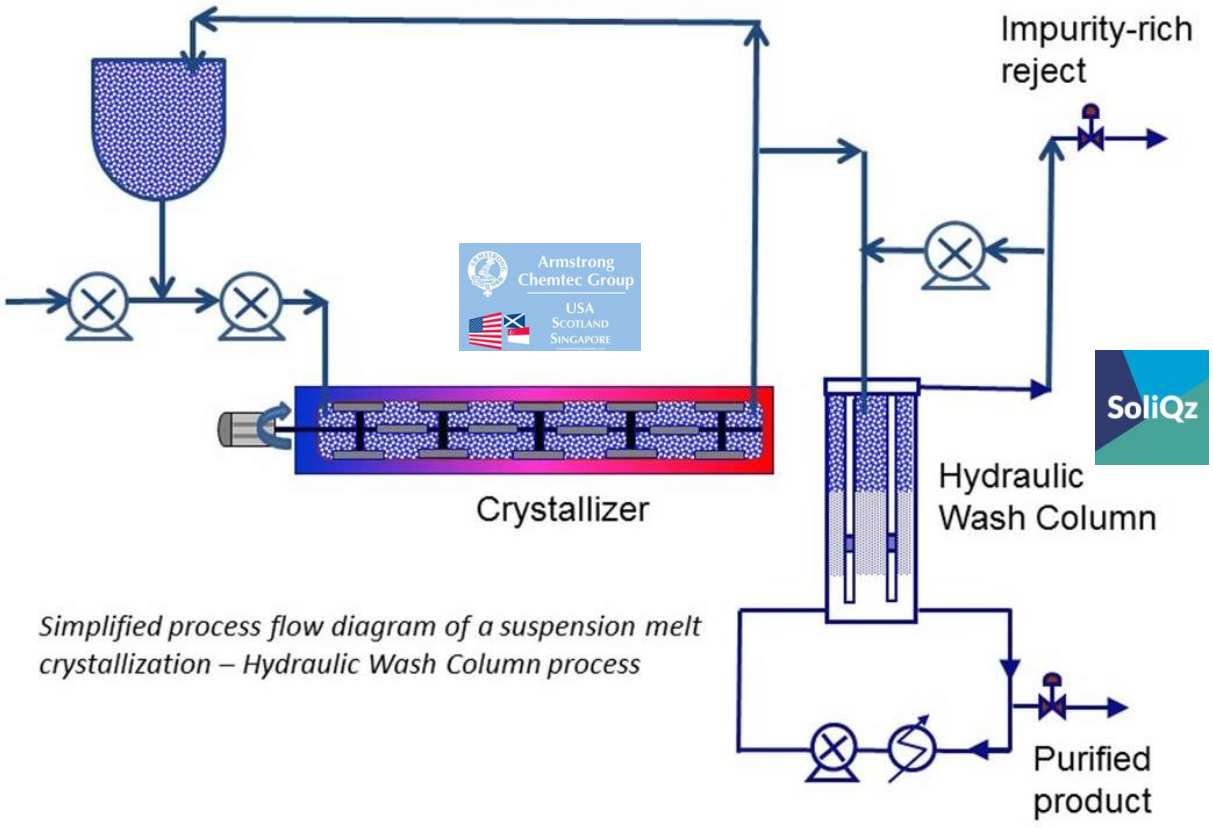
by bringing together:

- the proven Hydraulic Wash Column (HWC) technology from TNO,
- the state-of-art crystallisers and plant design/building experience from| Armstrong-Chemtec.

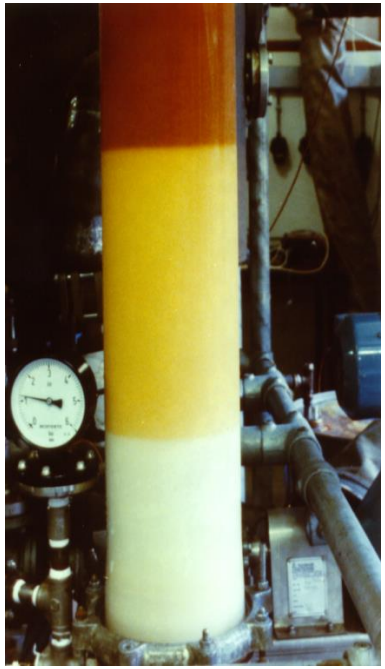
Present status:

- Founded in November 2013, 5 FTE's in 2018
- Armstrong-Chemtec (US/UK engineering company) as main shareholder
- Fully scalable technology with two industrial scale plants delivered;
- Partner in H2020 FIRST2RUN BBI-JU project
- Rapidly growing funnel of opportunities
- Pilot plant operational at PlantOne in Rotterdam (customer testing)
- Projected sales of 6-9 MM€'s (0,4 MM in 2018; 1,2 MM target in 2019)

HWC combines Solid-Liquid separation with highly efficient counter-current washing



Simplified process flow diagram of a suspension melt crystallization – Hydraulic Wash Column process



15 cm Hydraulic Wash Column operating with para-xylene

Melt crystallisation in combination with Hydraulic Wash Column: low cost process for high purity

Compound	[Impurity] Mother Liquor	[Impurity] Product	Melting T (°C)	Viscosity (mPa.s)
Para-xylene	10.8 wt%	0.07 wt%	13	0.7
Acrylic acid	4.8 wt%	0.04 wt%	13	1.25
Para-dichlorobenzene	5.98 wt%	0.025 wt%	53	1.0
Maleic Anhydride	4.03 wt%	0.03 wt%	53	2.4
Naphthalene	10.0 wt%	0.02 wt%	80	0.94
Ice/$MgSO_4$	27.7 g/l	0.032 g/l	0	1

- Over 20 years experience with HWC at pilot and industrial scale: successful tests for more than 50 chemicals
- HWC product typically contains 100-1000 lower concentration of impurities than the mother liquor in which the crystals were grown
- Proven in broad T- (-50 to +100°C) and η-range (0.35 to 50 mPa.s)

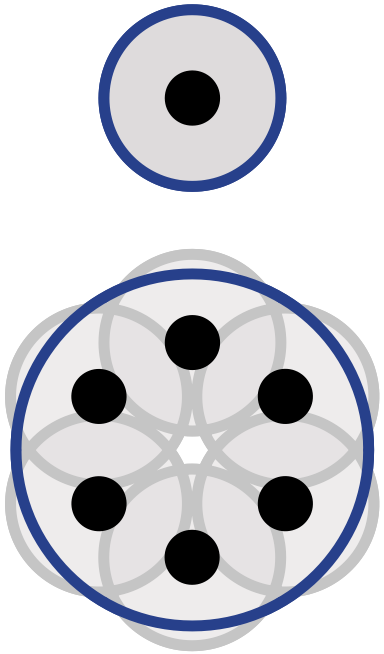
Scale up and scale down of HWC

Code	Diameter (cm)	# filter tubes	Typical production capacity (kg/hr)
HWC-2	2 New	0	1-10
HWC-8	8 New pilot plant	1	5-175
HWC-15	15	6	50-650
HWC-30	30 (in industry)	16	200-2500
HWC-55	55 (in industry)	50	1000-9000
HWC-110	110	200	4000-36000


HWC-2


HWC-30


HWC-55



Scale-up principle

Increase diameter and keep filtration area around tubes constant

Candidates for purification by (melt) crystallization and HWC-technology

The potential to be purified by (melt) crystallization and HWC technology has been proven/identified for more than 450 chemicals, including e.g.:

Bio-Based Chemicals

- Itaconic Acid
- Succinic Acid
- Cinnamic Acid
- Levullinic Acid
- DDDA
- Adipic Acid
- Lactide
- Glyoxylic Acid
- Sebacic Acid
- Lactic Acid
- FDCA
- Butanediol
- Azelaic Acid
- HMF
- Fumaric Acid
- Malic Acid
- ……..

Bulk and fine Chemicals

- Caprolactam
- Phosphoric Acid
- Maleic Anhydride
- N-Vinyl Pyrollidone
- Phthalic Anhydride
- Naphthalene
- Benzoic Acid
- Di-aminohexane
- Methacrylic Acid
- Acrylic Acid
- Phenol
- MDI
- PDCB
- PNCB
- ONCB
- TDI
- $NaOH \cdot 1\ H_2O$
- ……..

Your product not on the above lists? Ask for a free desk evaluation

Producers of specialty and bio-based chemicals get high purity (upto 99,9%) products in a continuous, single step process and with:

Reduced OPEX:

- Energy savings of 20% up to 90% versus distillation
- No use of solvents
- No wash liquid consumption.

Reduced CAPEX:

- Truly continuous process with throughput up to 36 MT crystals per m2/hr.

Operational benefits:

- Reliable operations, lower maintenance: NO rotating/moving parts.
- Stable operation due to intrinsic self-correction of the process

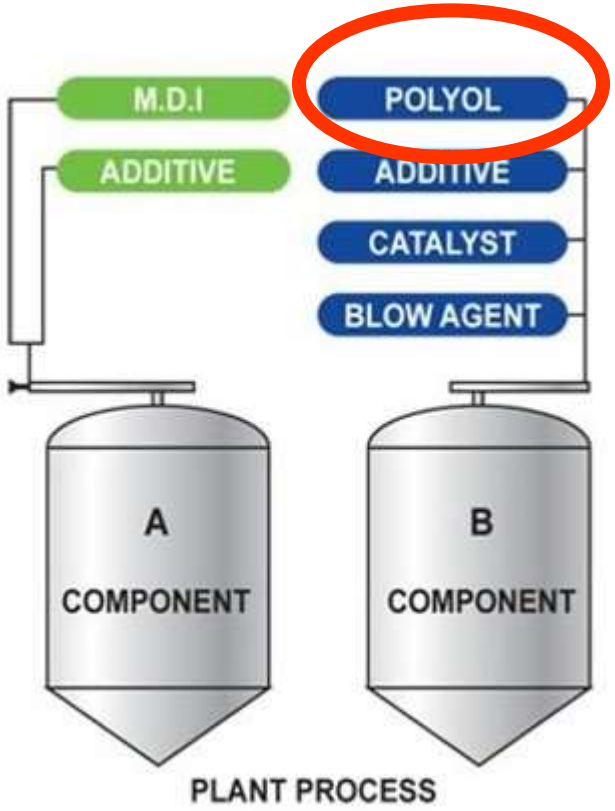
POLYLABS™
BIOPOLYOL SYSTEMS

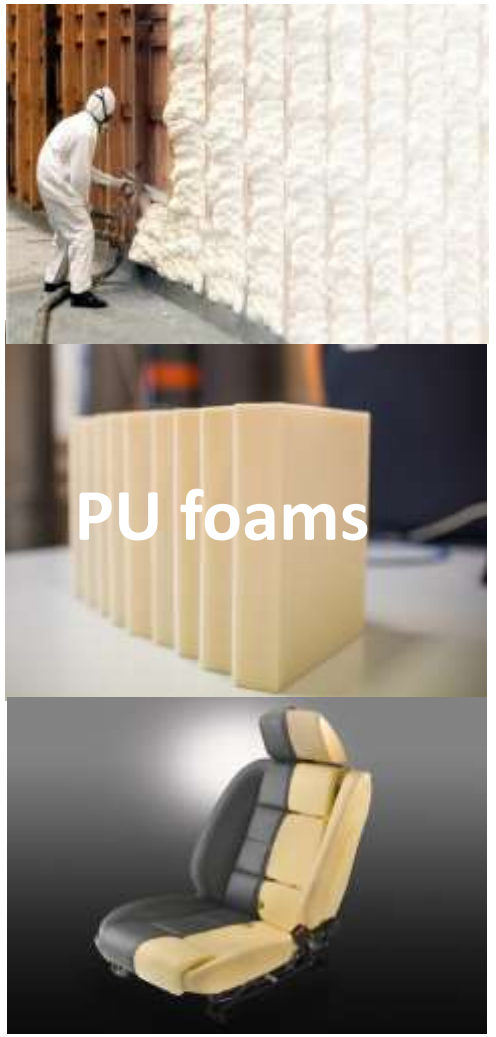
BIO BASED POLYOLS

for the polyurethane industry

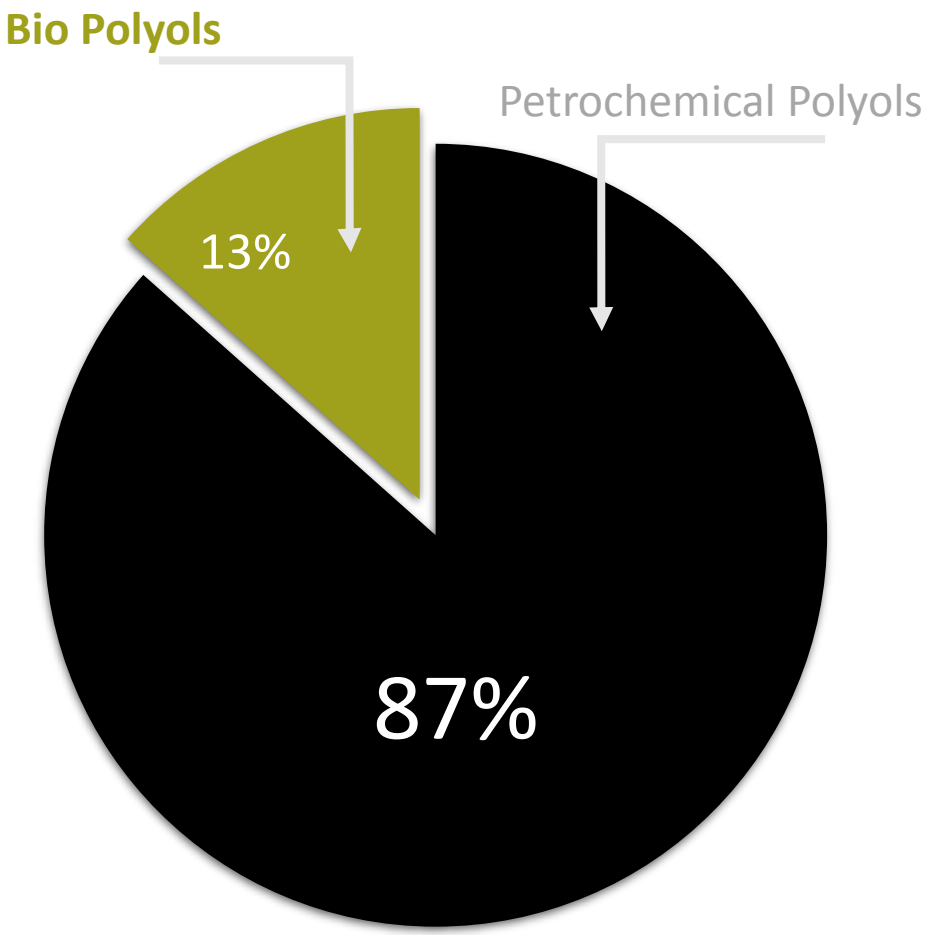
How its made?

Liquid chemicals





THE MARKET



- polyol market **$ 21 bn**
- annual growth 8,5%
- Bio polyol market **$ 2,88 bn**
- Annual growth 9,5%
- **Shifting market trend**

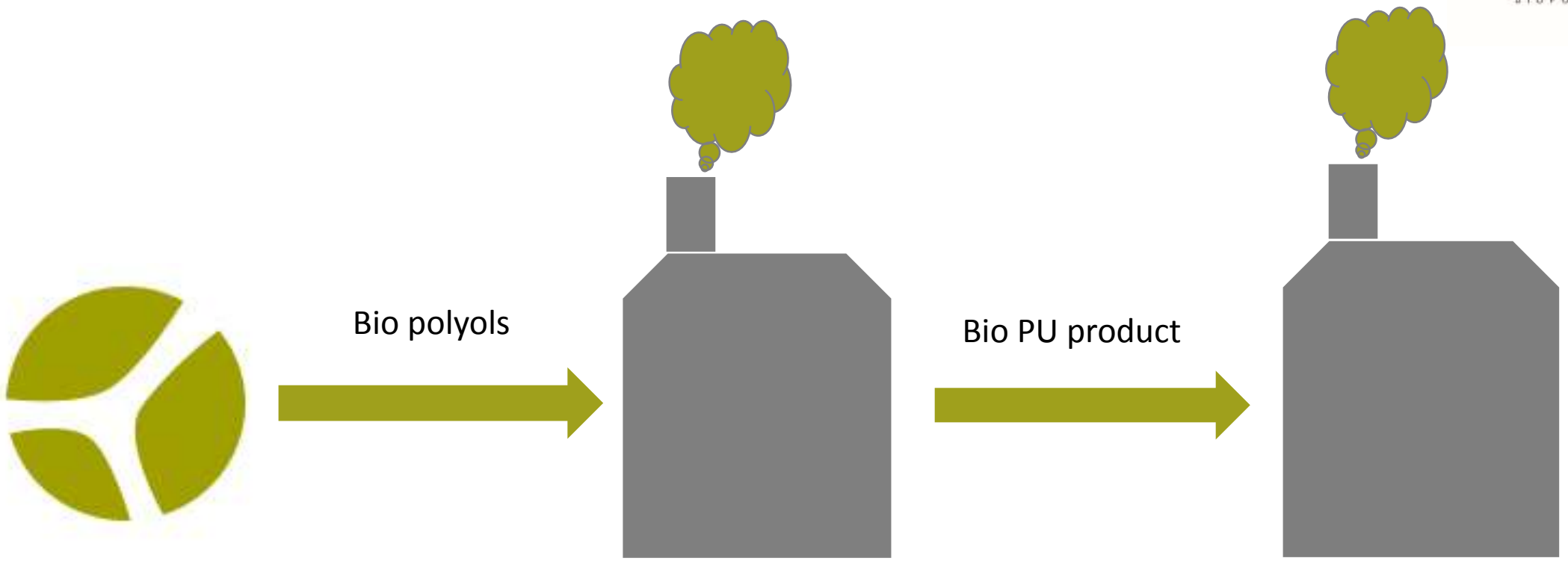
INDUSTRY PROBLEM

POLYLABS™
BIOPOLYOL SYSTEMS

Industry can not satisfy **growing market demand** for reasonably priced **bio based products**.

- **Growing** Bio product demand
- **Expensive** Bio polyol alternatives
- **High CO2** footprint
- **No access** to green markets
- **No eco** certification
- **Dependance** of crude oil price

THE DEAL



POLYLABS produces bio polyols

PU systems/product producer

End user

TECHNOLOGY

POLYLABS™
BIOPOLYOL SYSTEMS

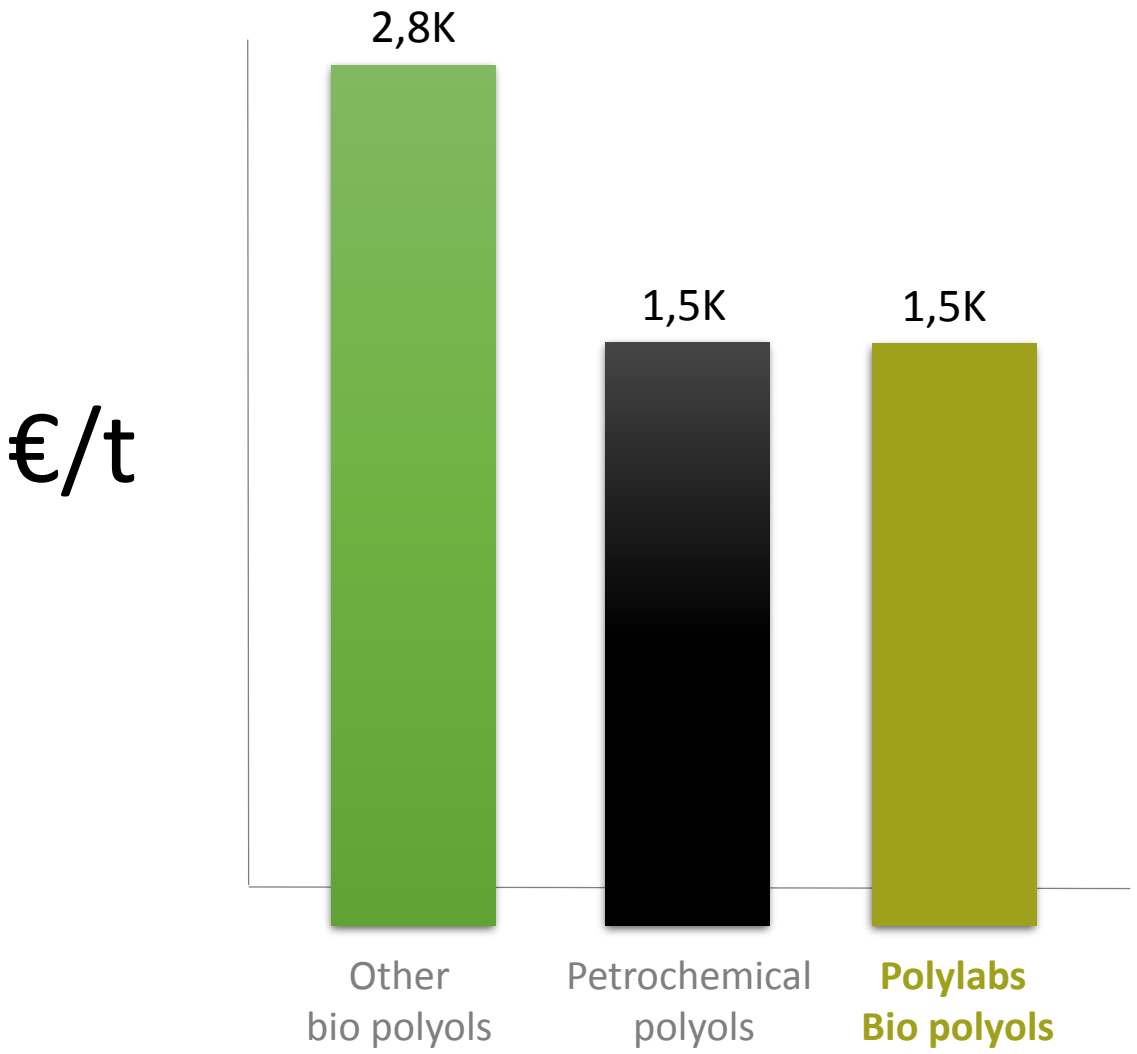
NATURAL OILS

POLYLABS TECHNOLOGY

BIO POLYOLS

- One step process
- Wasteless technology
- Resource efficient

VALUE PROPOSITION



- Price match to fossil based
- High % renewable content
- Access to green markets
- Reduced CO2 footprint
- ECO certificate compliant
- Save $ in PU production
- Technical advantages

THE TEAM

Kristiāns Grundštoks

Founder, CEO

Background in law, experience in sales and international business

Edgars Vanags

R&D

Organic chemistry and polyol development specialist

Miķelis Kirpļuks

Co-founder, R&D

Experienced polyurethane scientist

Dr. Daniel Auriel

Advisor

15+ years experience in chemicals & materials incl. Bayer, StoraEnso, EEnergy, Capricorn venture partners

ADVISORS

Dr. Ugis Cabulis

SB member, advisor

Director of the Institute of wood chemistry of Latvia

TIMELINE

- Founded in 2014
- Total investment 200 k EUR
- 3 products ready, 2 in development
- Production capacity 3000 t/year
- Sales channels in 19 countries
- Revenue 2017 11 k EUR
- Revenue 2018 72k EUR

- Production expansion in 2019 to 10 000 t/year

Polylabs production facility

FUNDING OPPORTUNITY
5 m EUR

POLYLABS™
BIOPOLYOL SYSTEMS

1st phase

600k EUR

Use of funds

- Team expansion
- Sales & Marketing
- R&D, patents

2Y milestones

- Volume 3 200 t
- Revenue 5 MEUR
- EBITDA 0,88 MEUR
- EBITDA Margin 17%

2nd phase

4.4m EUR

Use of funds

- Capacity expansion to 10 000 t p.a.

3Y milestones

- Volume 47 000 t
- Revenue 73.3 MEUR
- EBITDA 23.7 MEUR
- EBITDA Margin 32%

Kristiāns Grundštoks

Founder, CEO

kristiansg@polylabs.eu

www.polylabs.eu

Colsen

water, energy & environment

Colsen

Water, energy & environment

Bio sulphuric acid as a potential fungicide and/or herbicide

Aleksandra Alicja Kulagowska

7 November 2018

Pitch perfect and boost the European Bio-Economy
Cross-border pitching, matchmaking and networking event

Date: Wednesday 7th November 2018
Location: Sheraton Brussels Airport Hotel, Brussels Airport, Belgium

Matchmaking & networking event enabled by:

Interreg North-West Europe BioBase4SME

Superbio

Index

- I. Colsen - introduction
- II. Biogas treatment – genesis of the idea
- III. Sulphur in Biogas into a valuable product



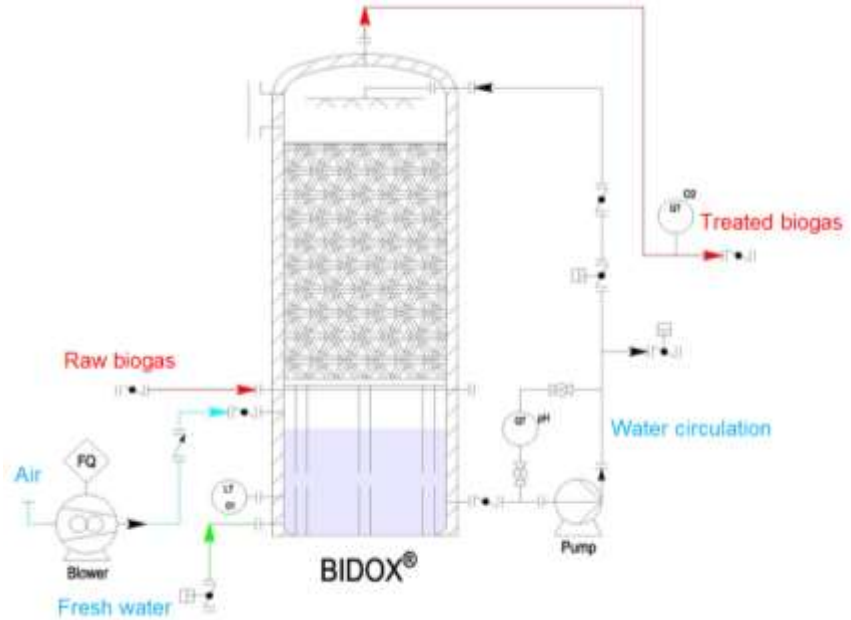
I. Colsen - introduction

Bullet points:

- ❖ **Consultancy agency and construction & engineering Company in the water, energy and environment sectors www.colsen.nl**
- ❖ **~30 years of experience**
- ❖ **Products:**
- ➢ **Nitrogen recovery and removal from wastewater,**
- ➢ **Phosphorus recovery,**
- ➢ **Biogas production (TD, UASB),**
- ➢ **Biogas treatment**

II. Biogas treatment – genesis of the idea

BIDOX®-> Biological biogas **D**esulphurization by **Ox**idation



$$H_2S + 2O_2 \rightarrow SO_4^{2-} + 2H^+$$

Flush water -> diluted bio-sulphuric acid (pH ~ 1.5) with traces of elemental sulphur

III. Sulphur in Biogas into a valuable product

BIDOX® has a huge market:

⇒**Anaerobic wastewater treatment (UASB)**

⇒***Potato's industry***

⇒***Paper industry***

⇒***Slaughterhouses***

⇒***Dairy industry***

⇒***Fruit & vegetables industry***

⇒***…***

⇒**Thermophilic digestion of industrial organics**

⇒**Thermophilic digestion & co-digestion of manure**

⇒**Thermophilic sludge digestion**

⇒**Landfill gas**

The Netherlands	9
Belgium	2
Spain	2
Itali	2
USA	3
UK	1
Cech Republic	1
Totaal	**20**

III. Sulphur in Biogas into a valuable product

What => *BIDOX® bio-sulphuric acid possible application as herbicide/pesticide/fungicide…*

Potential in Nl: 7610 m^3 of diluted bio-H_2SO_4/day => 2,7 million m^3/year

Why => *(ordinary) H_2SO_4 was used in the past (and it was working)*

- *Strong pH shift shows fungicides and weed suppression potential*
- *Systemic products for fungicides and weed control (glyphosate based) need an alternative*

Where are we => *Beginning of the research process, new partners are more than welcome…*

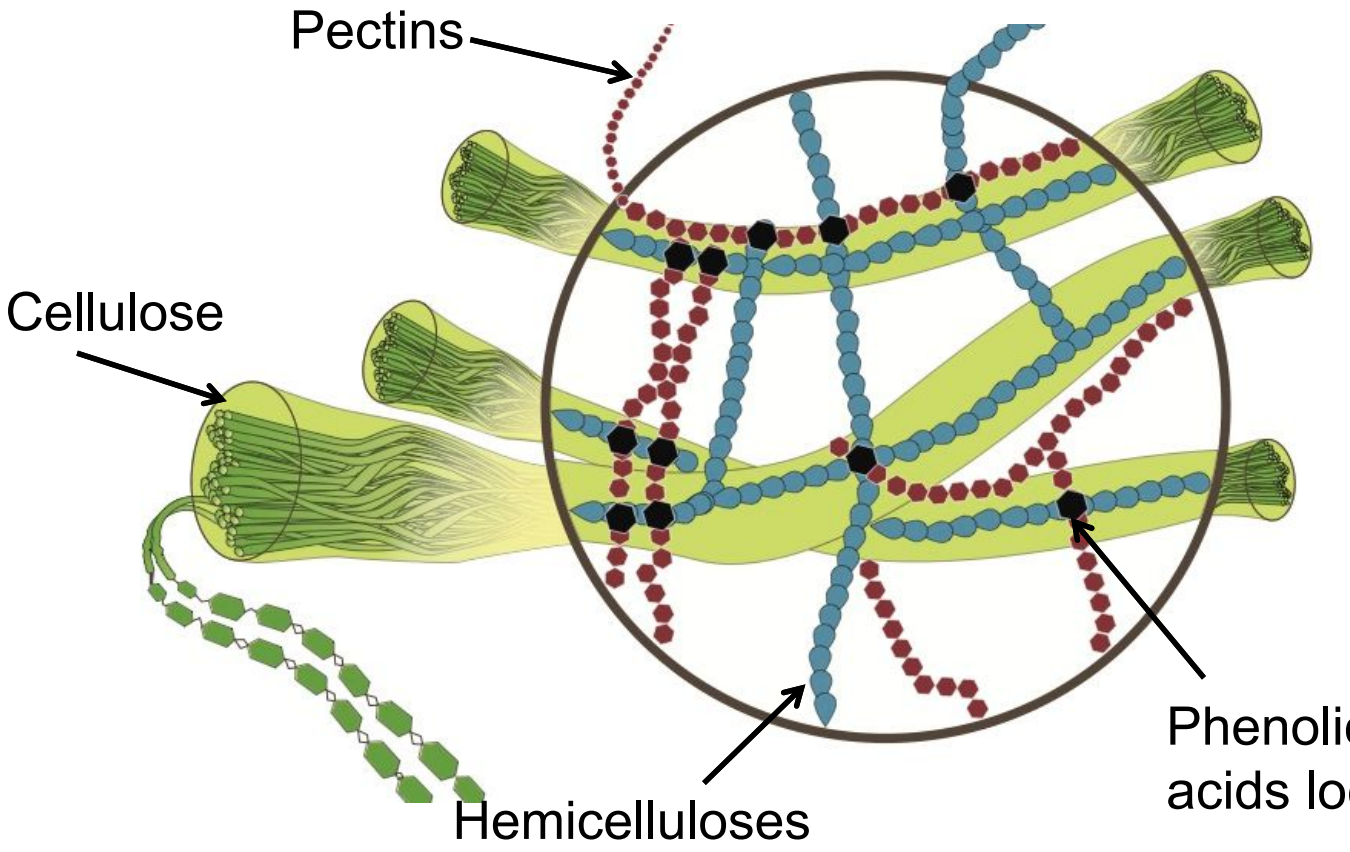
BIOLIE

L'extraction au sens propre

WHO WE ARE

- **Industrial company,** created in **January 2012,** specialized in enzymatic extraction of plant origin **natural ingredients**
- 9 people including **4 PhD** & **3 engineers**
- **250 plants** studied – 80 R&D contracts – **6 patents**
- Catalog of **22 cosmetic** ingredients et **2 nutraceutical** ingredients
- Present in **25 countries** through a distribution network and partners
- **Our Business activity:** design, develop, produce and Commercialize natural ingredients for Cosmetic and Nutraceutical markets
- **Our proposal**:
  - Development of our own ingredients
  - Service delivery (R&D, patent licence, production)

HOW TO GET THE BEST OF A PLANT ?



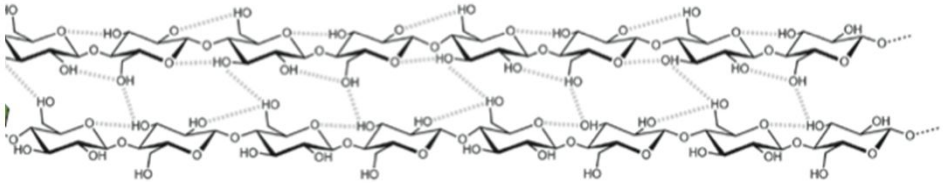
Composition
of cellular wall
of raw material?

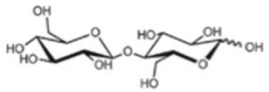
Enzymes for
selective hydrolysis
and synergy?

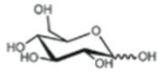
Ricochon and Muniglia (2010). OCL, 17 (6) 356-359.

ENZYMES: A KEY FOR BIOREFINERY

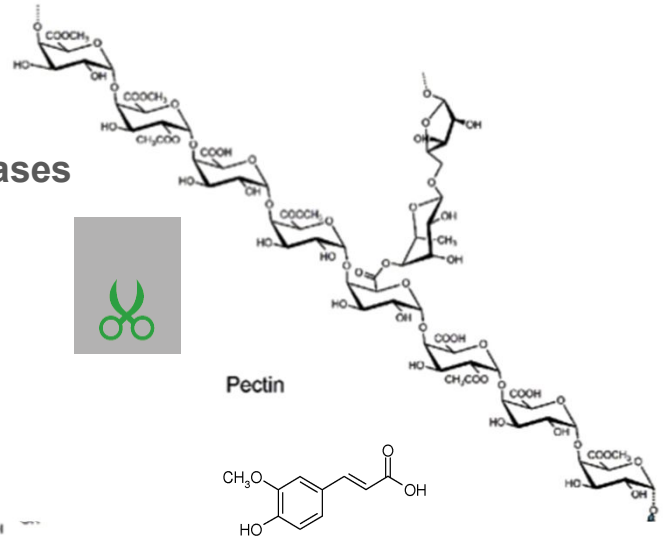
Cellulases

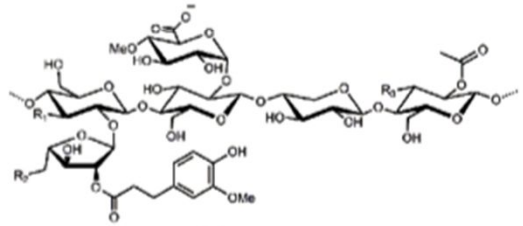


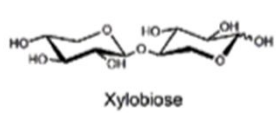


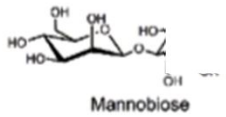


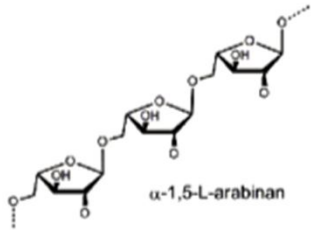
Pectinases

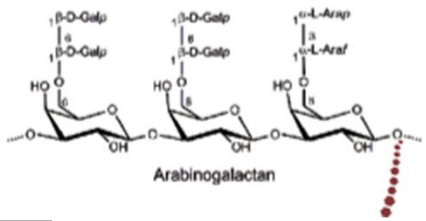


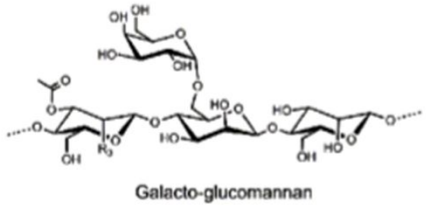










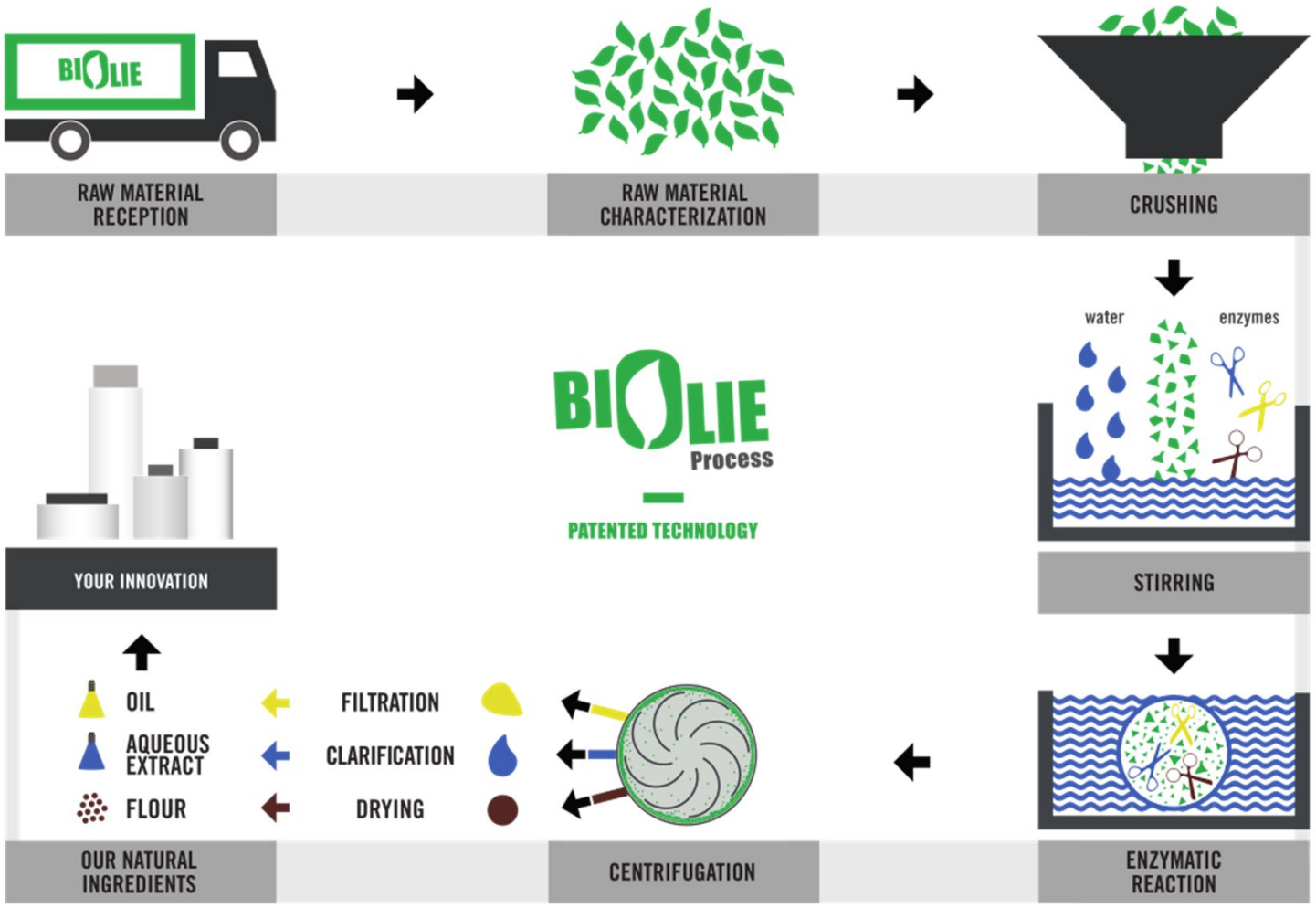


Hemicellulases

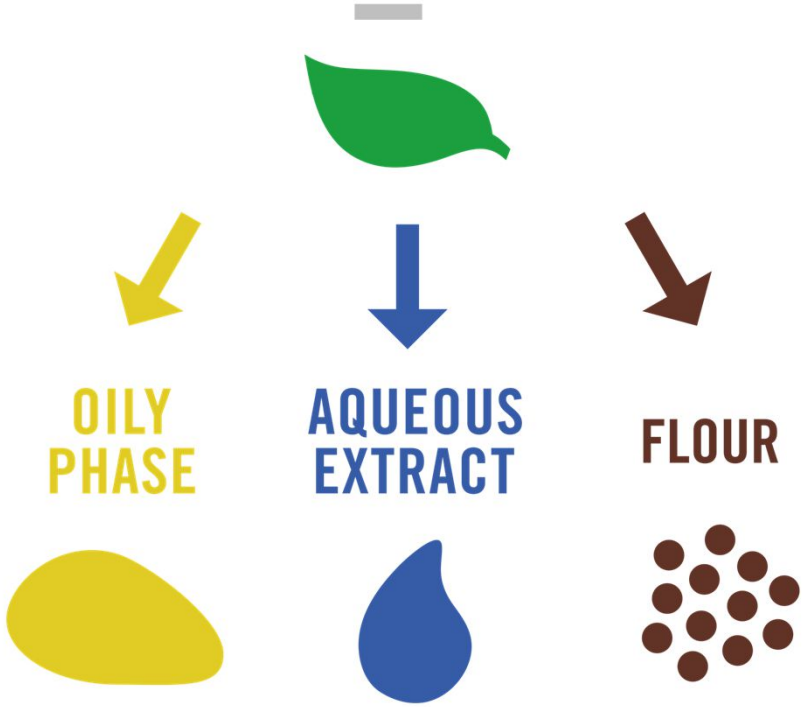
Proteases

Phenolic acids locks

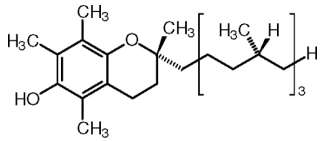
OUR TECHNOLOGY

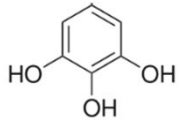


THE BIOREFINERY CONCEPT



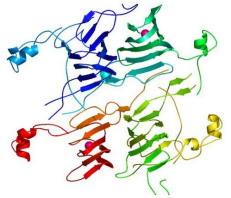
Tocopherols
Sterols
Apolar compounds





Polyphenols
Fermentescible sugars
Oligosaccharides
Hydrosoluble proteins…

Polyphenols
Oligosaccharides
Proteins
Fibers
…



ADVANTAGES OF OUR TECHNOLOGY

Sustainable technology: solvent-free and organic compound-free
→ Possibility to get certifications: **ORGANIC, COSMOS...**

« Biomimicry »: technology inspired by nature and worldwide patented

Biorefinery: the only technology that produces **several natural ingredients** through a one-step extraction: a vegetable oil, an aqueous extract and a solid fraction.

Specificity of the extraction: naturally enriched oils and innovative and differentiating aqueous extracts with **enhanced efficiency.**

China list and **Plants Decree**

THANK YOU FOR YOUR ATTENTION

Stéphanie ALVES, BDM
stephanie.alves@biolie.fr

BIOLIE
13 rue du bois de la champelle
54500 VANDOEUVRE-LES-NANCY
France
+33 3 83 37 28 17
+33 3 83 68 52 71
www.biolie.fr

KitoSano s.l.

High-quality Chitosans from Crayfish waste

José Luis Grau, CEO

The Problem

- The lack of high-quality chitosans is hampering innovation is emerging key industries

Chitosan and derivatives are found n

- wound healing dressings
- orthopaedic scaffolds
- nerve regrowth and protection tubes
- Dental / bracket protection coatings
- …

The Problem

- Bio-degradable solutions are needed for plastic ban
- Chitosan based materials are promising alternatives to plastics (e.g. food packaging foils

The Problem

- EU's dependency from a critical raw material
- Chitosan is mostly produced in South East Asia
- no EU manufacturer covering the whole process chain

The Problem

- **Illegal crayfish waste disposal risks at creating severe environmental problems at the outskirts of the Doñana National Park**

The Solution

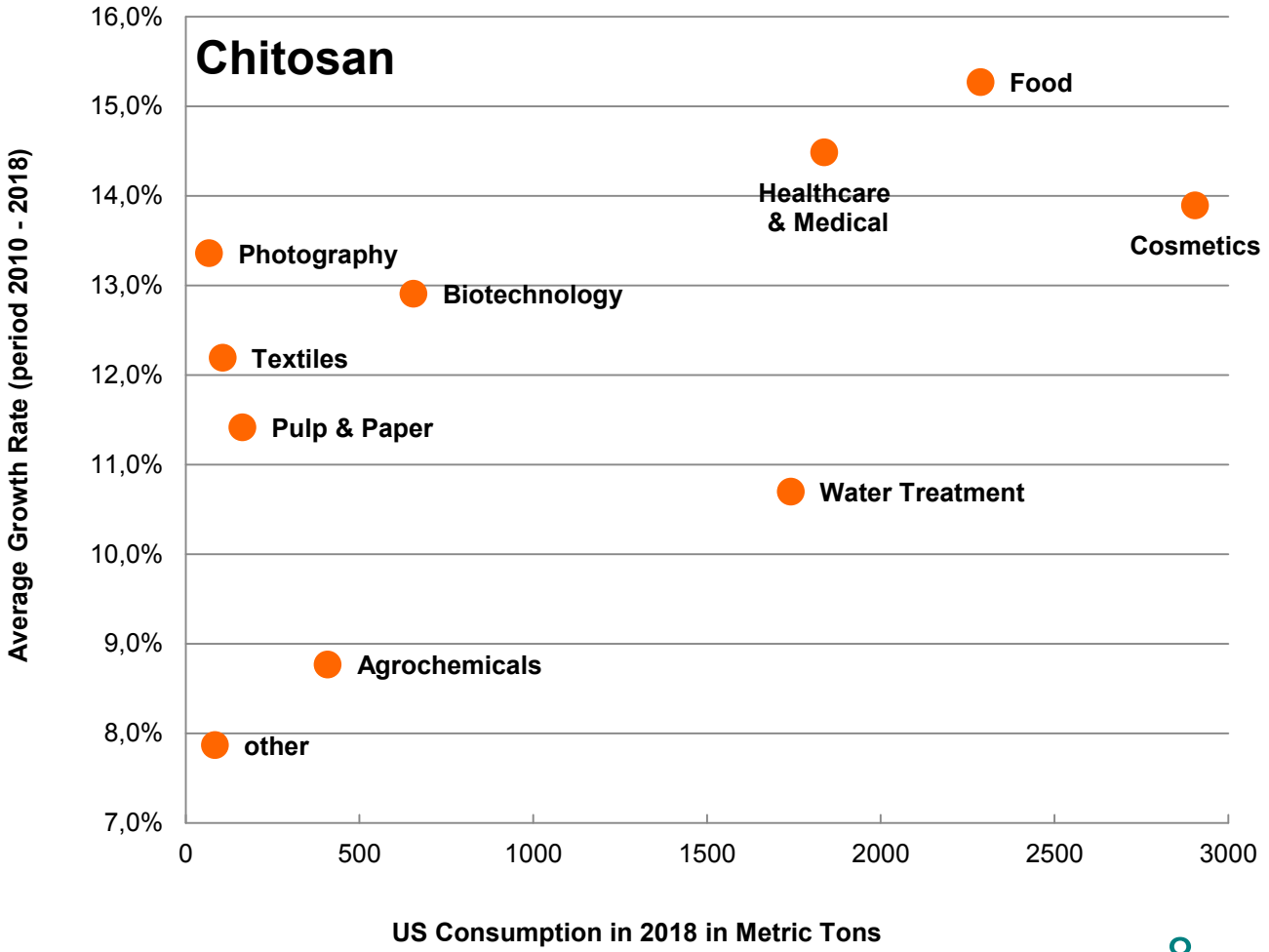
- KitoSano aims at producing bio-based, high-end chitosan in economic competitive and eco-friendly way.
- The production will be Andalusia, one of Europe's region with the highest unemployment rate

The value proposal

This value chain has been established with the support of Superbio

The Market

- World: market for Chitosan $2000 million in 2015, two digit annual growth rates over the past five years
- Europe: 10.6% of the global production or 3896 metric tons
- food, healthcare & medical and cosmetics are the sectors with the highest growth rates



The Project

Phase 1: R&D	completed
Phase 2: Scale-Up	In progress
Phase 3: Production	Under planning

What we are looking for

Unicorn

Purpose:	Exponential growth
Outcome:	Monopoly
Focus:	Quantity
Method:	Competition
Measure:	User acquisition

Zebra

Purpose:	Sustainable prosperity
Outcome:	Community
Focus:	Quality
Method:	Collaboration
Measure:	User success

Thank you for you attention

KitoSano acknowledges the support of

AppliSurf

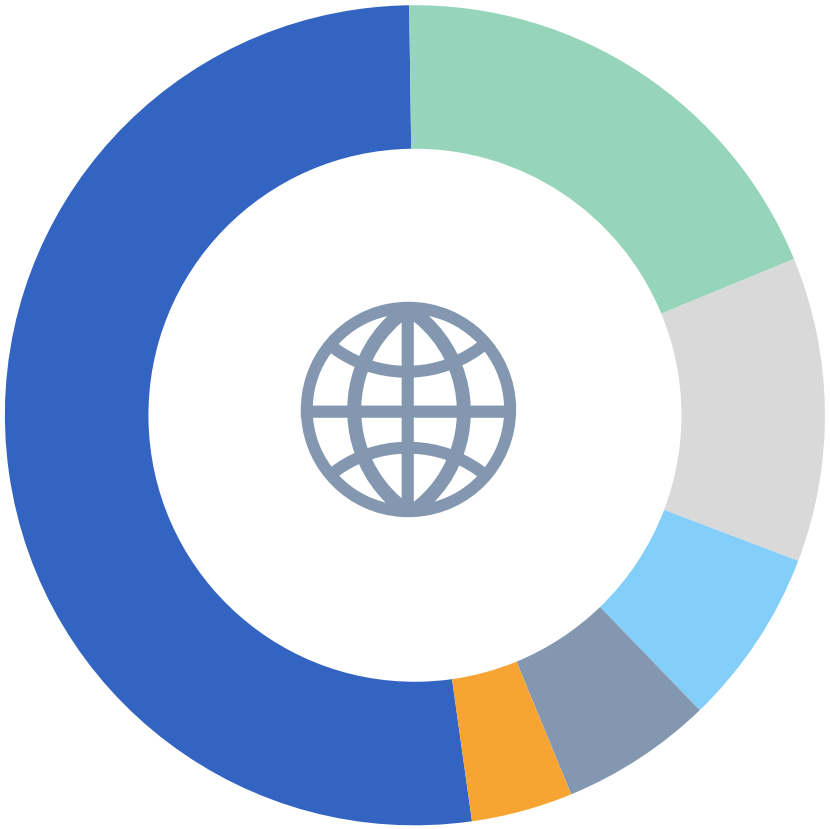
BRINGING NEW BIOSURFACTANTS TO MARKET:
JOIN US IN APPLISURF

Join the Industry User Group Today!

Dr. Ir. Sophie Roelants
Project Coordinator Biosurfactants InBio/BBEPP

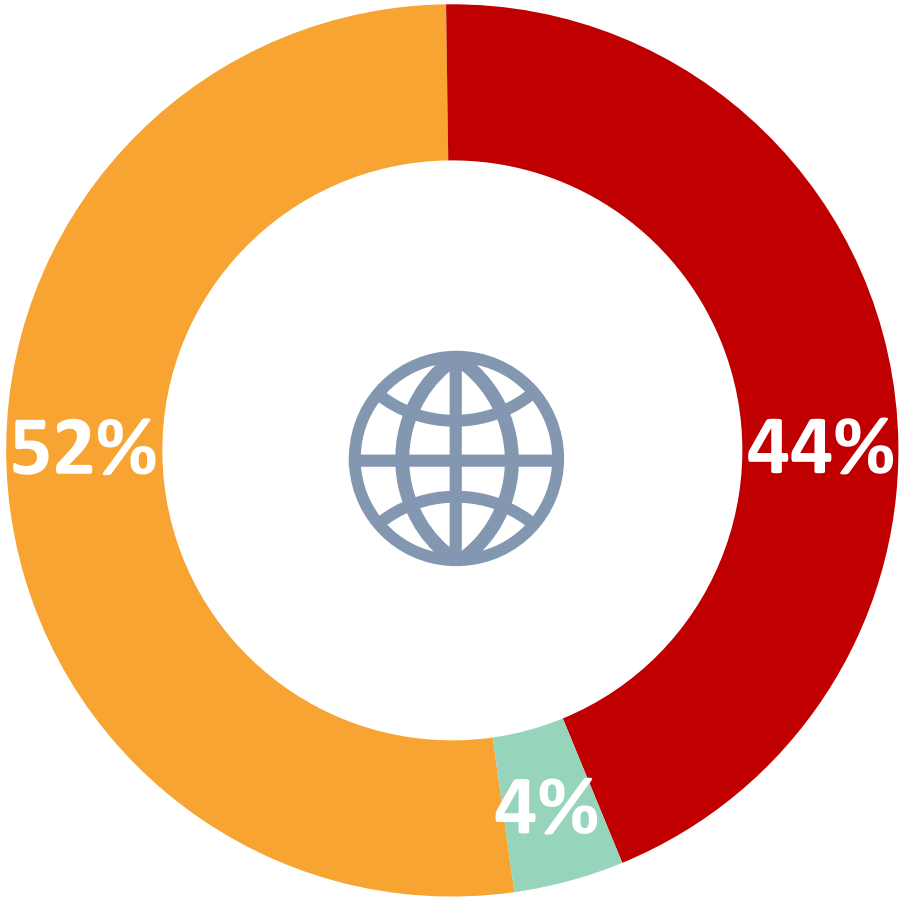
01. Surfactants: applications?

01. Surfactants: applications and market



52%	Household detergents
19%	Others (paints & inks, oilfield chemicals, textiles,...)
12%	Personal Care
7%	Industrial cleaners
6%	Food processing
4%	Agricultural chemicals

01. Origin of surfactants

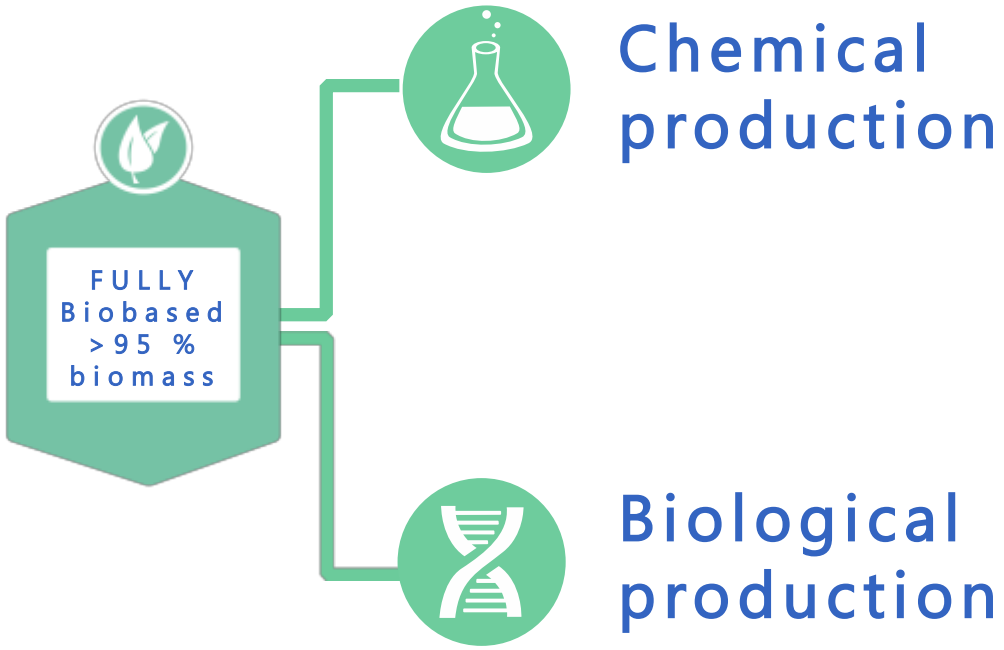


NON biobased surfactants
< 5 % biomass derived

PARTLY biobased surfactants
+/- 40 % biomass derived

FULLY biobased surfactants
> 95 % biomass derived

01. Production of bio surfactants



Chemical production

Biological production

01. Biological production: fermentation

Biological production

Plant extraction

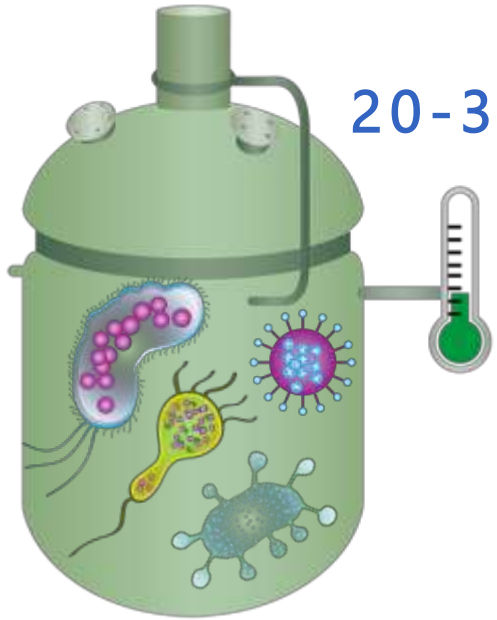
Biocatalysis (Enzymatically)

Fermentation (Microbial)

01. Microbial biosurfactants

MEDIUM IN:
- Proteins (nitrogen)
- Sugars (carbon)
- Vitamines
- Salts
- Water
- …

SUBSTRATES

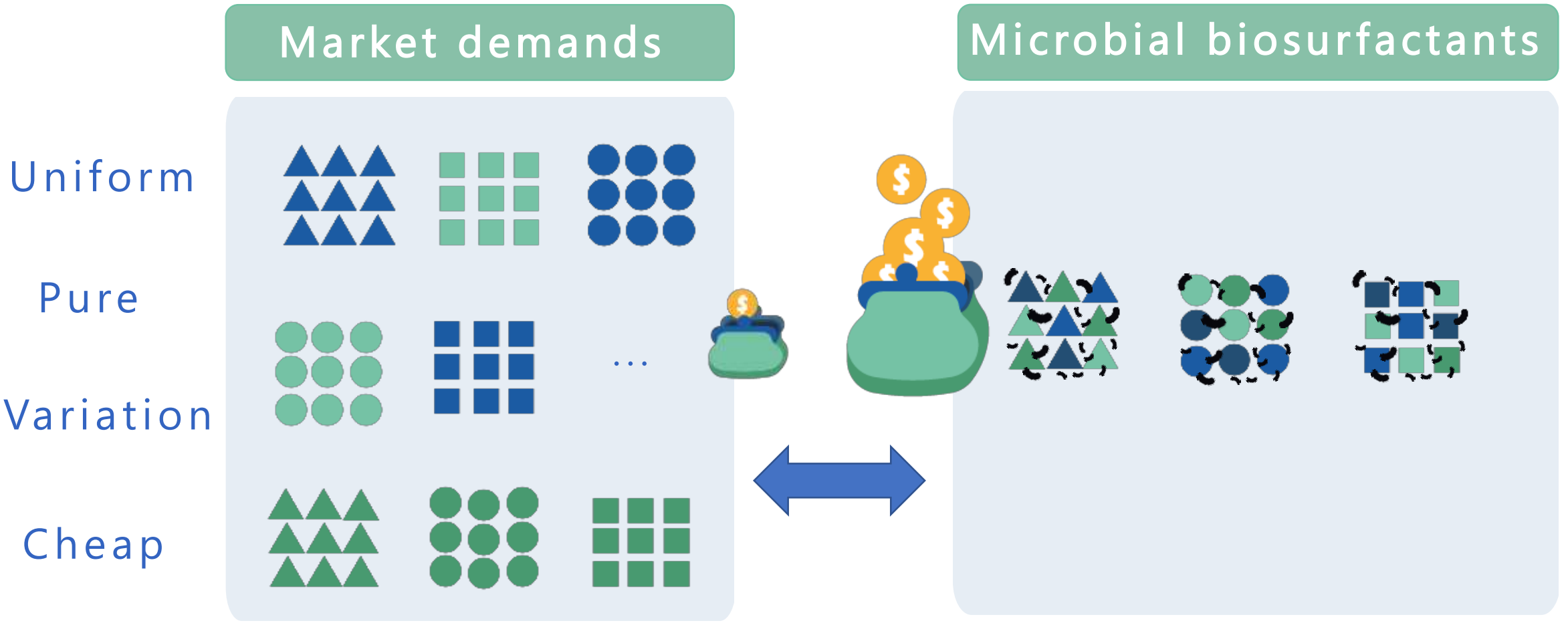


20-37°C

Fermentation

BROTH OUT:
- Biosurfactant
- CO_2
- Cells
- Metabolites
- Unused medium/ substrates
- Water
- …

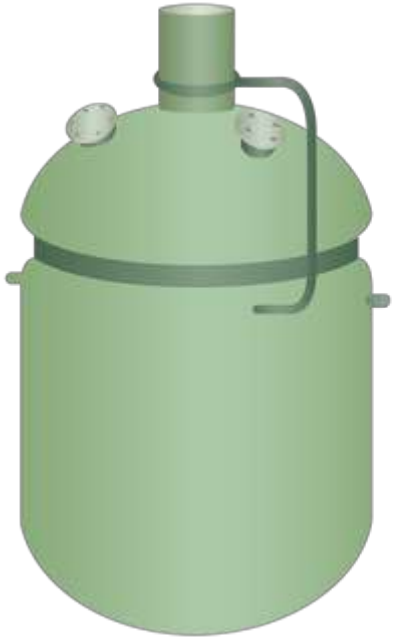
01. Disadvantages of Microbial biosurfactants



02. Solving the bottlenecks

From LAB to Market: IBD

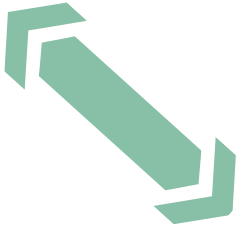
Process development & scale up

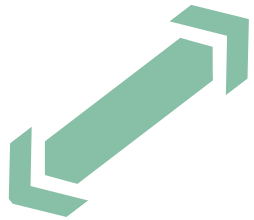


Uniform

Pure

Cheap

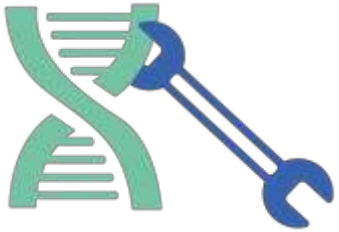




(New-to-nature) sophorolipids

Application research and Characterisation

Genetic Engineering



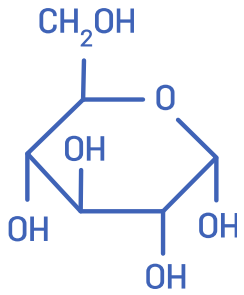
Uniform

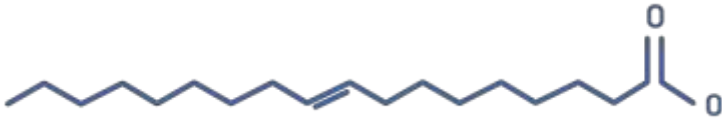
Variation

Cheap

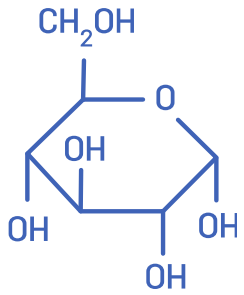
02. Workhorse: *Starmerella bombicola*

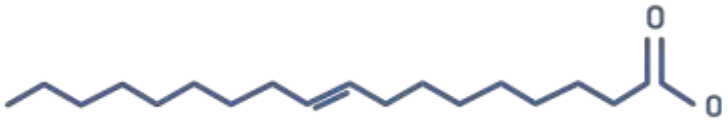
02. Workhorse: *Starmerella bombicola*



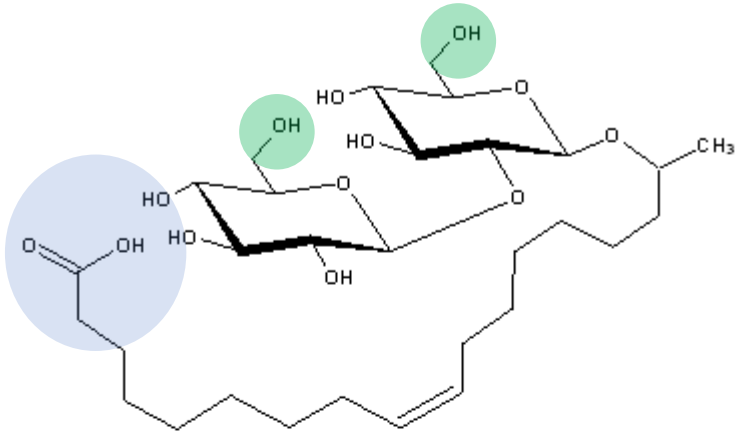


02. Workhorse: *Starmerella bombicola*

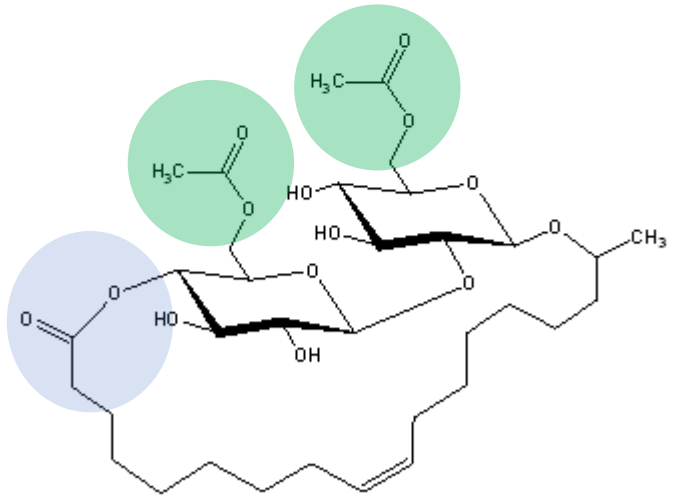




Starmerella bombicola



Acidic form, non acetylated



Lactonic form, diacetylated

02. Sophorolipids: commercial reality

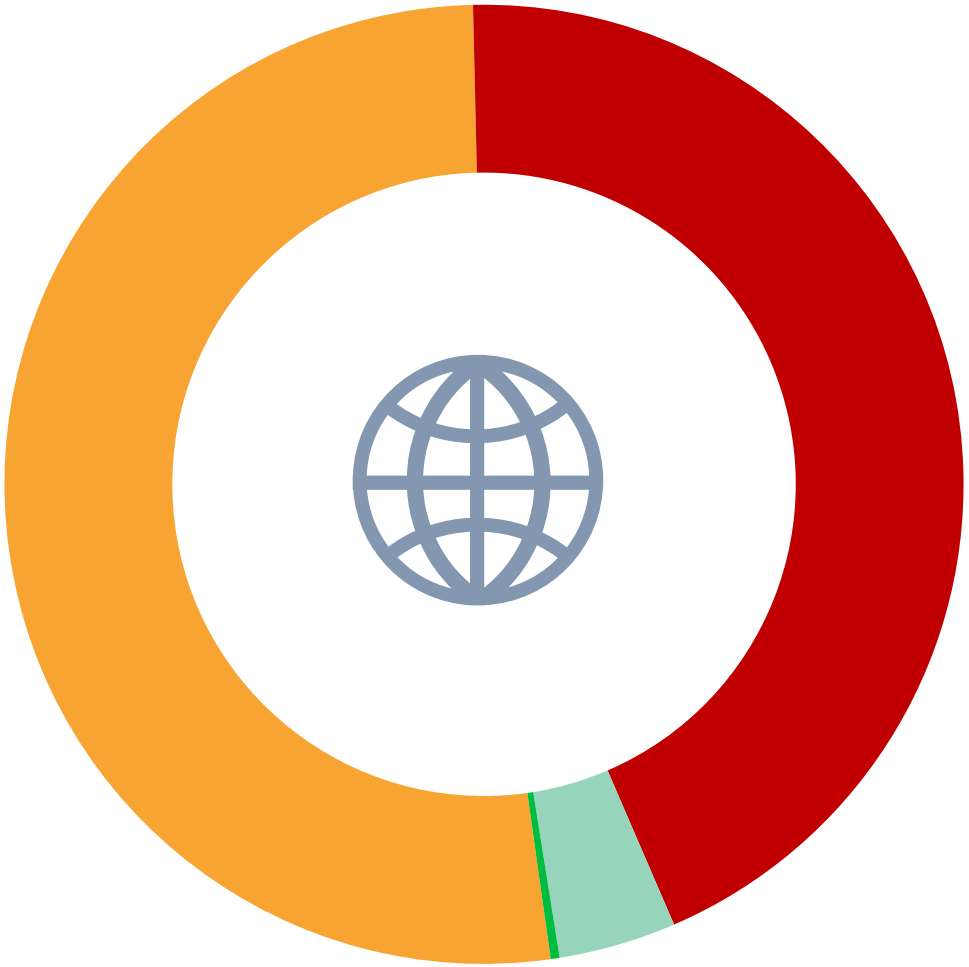
Fermentation (Microbial)

Glycolipids

>> Sophorolipids

- Produced by yeasts
- Low foaming surfactant
- Mild antimicrobial properties (anti acne, anti odor,...),
- Antiviral, - cancer, ...
- Applications: detergents and cosmetics
- Part of the Carbosurf project (UGent, InBio.be)

02. Microbial biosurfactants: market



NON
biobased surfactants

PARTLY
biobased surfactants

FULLY
biobased surfactants

Microbial biobased surfactants: < 0.1 %

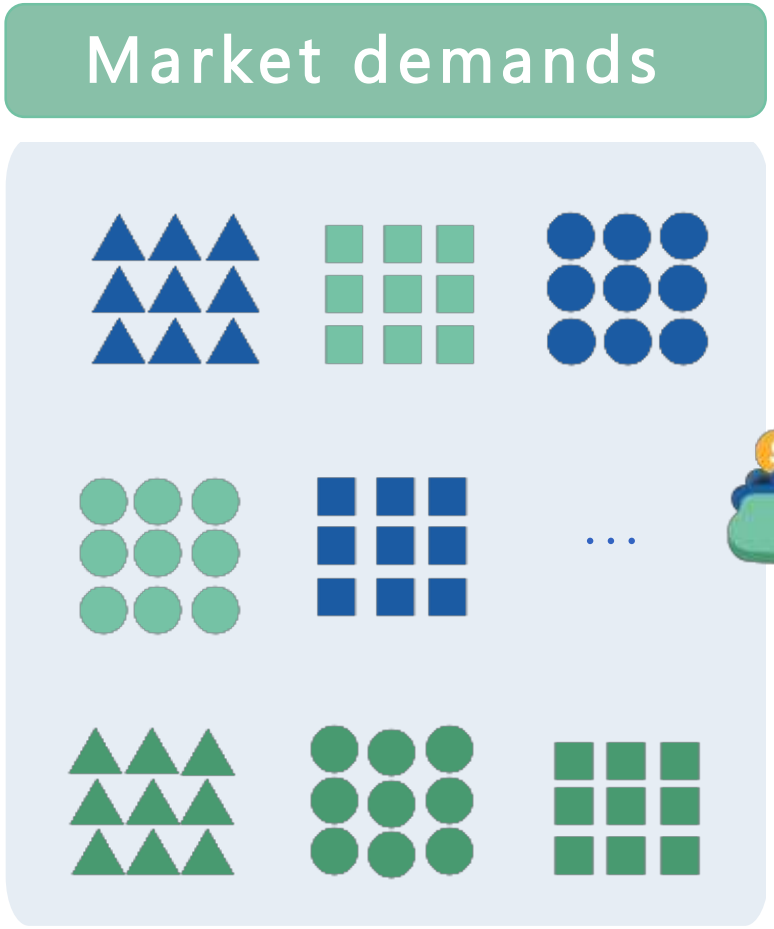
02. Disadvantages of Microbial biosurfactants

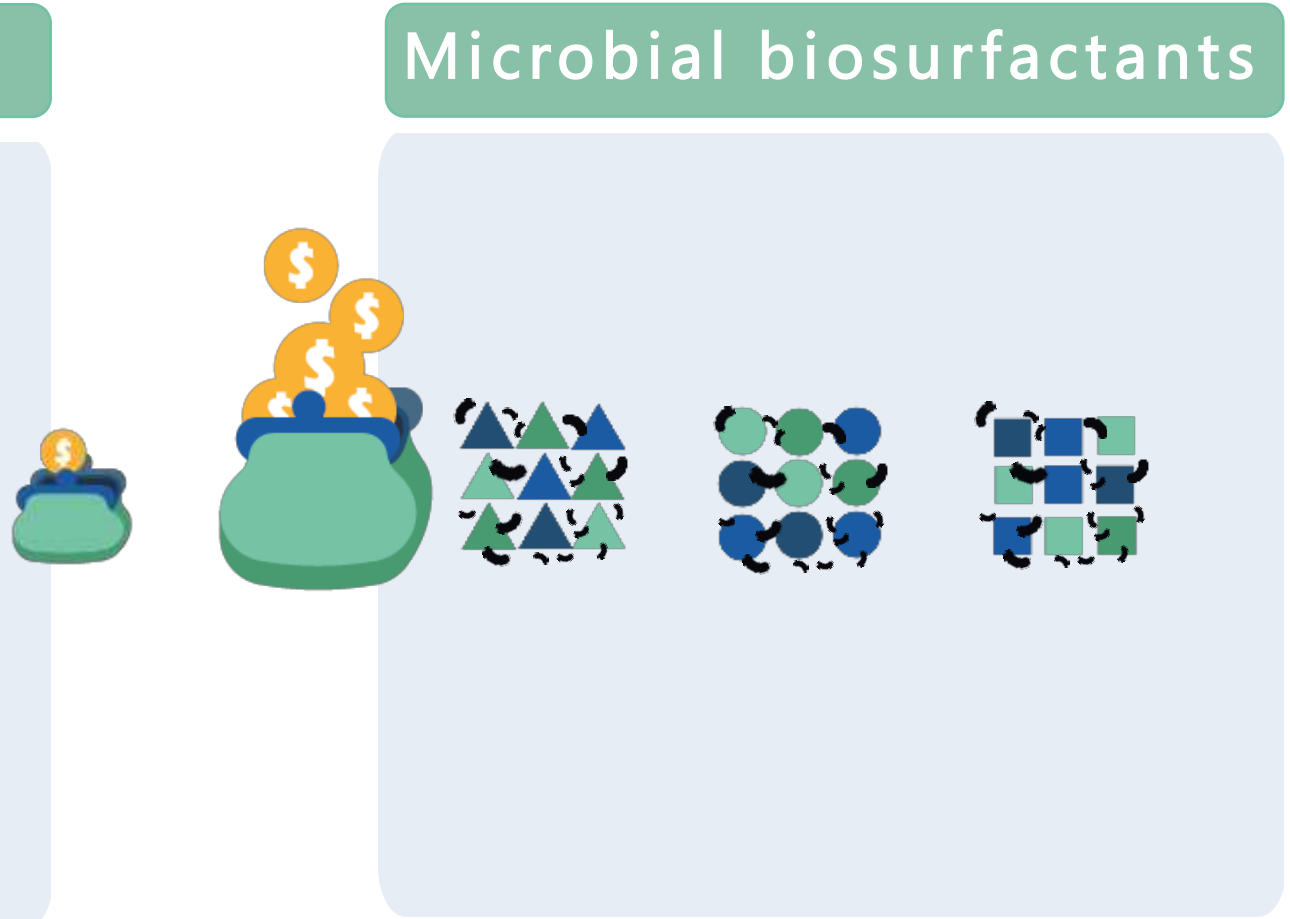
Uniform

Pure

Variation

Cheap

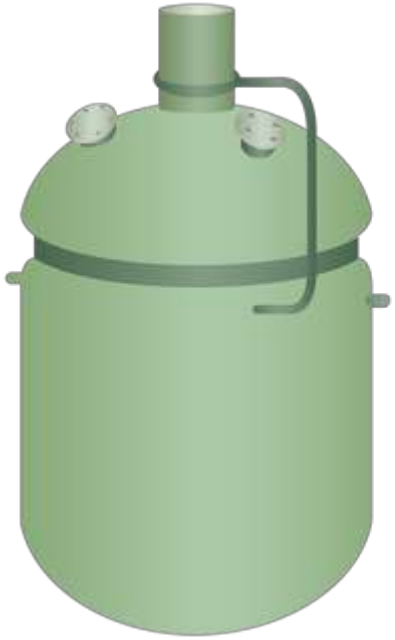




03. Solving the bottlenecks

From LAB to Market: IBD

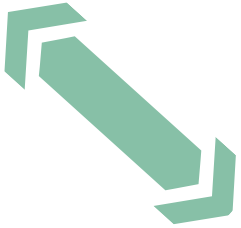
Process development & scale up

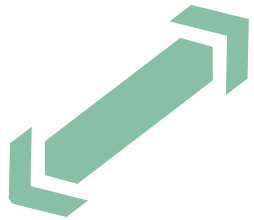


Uniform

Pure

Cheap

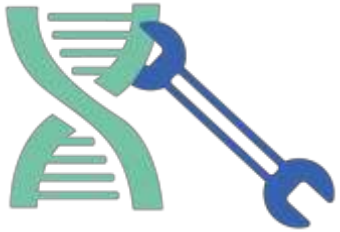




(New-to-nature) sophorolipids

Application research and Characterisation

Genetic Engineering



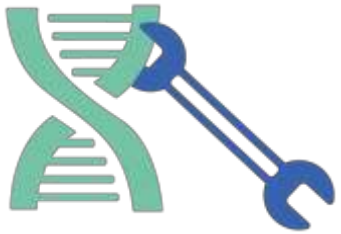
Uniform

Variation

Cheap

03. Solving the bottlenecks

Genetic Engineering

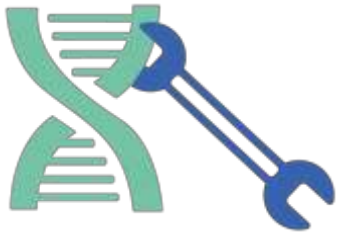


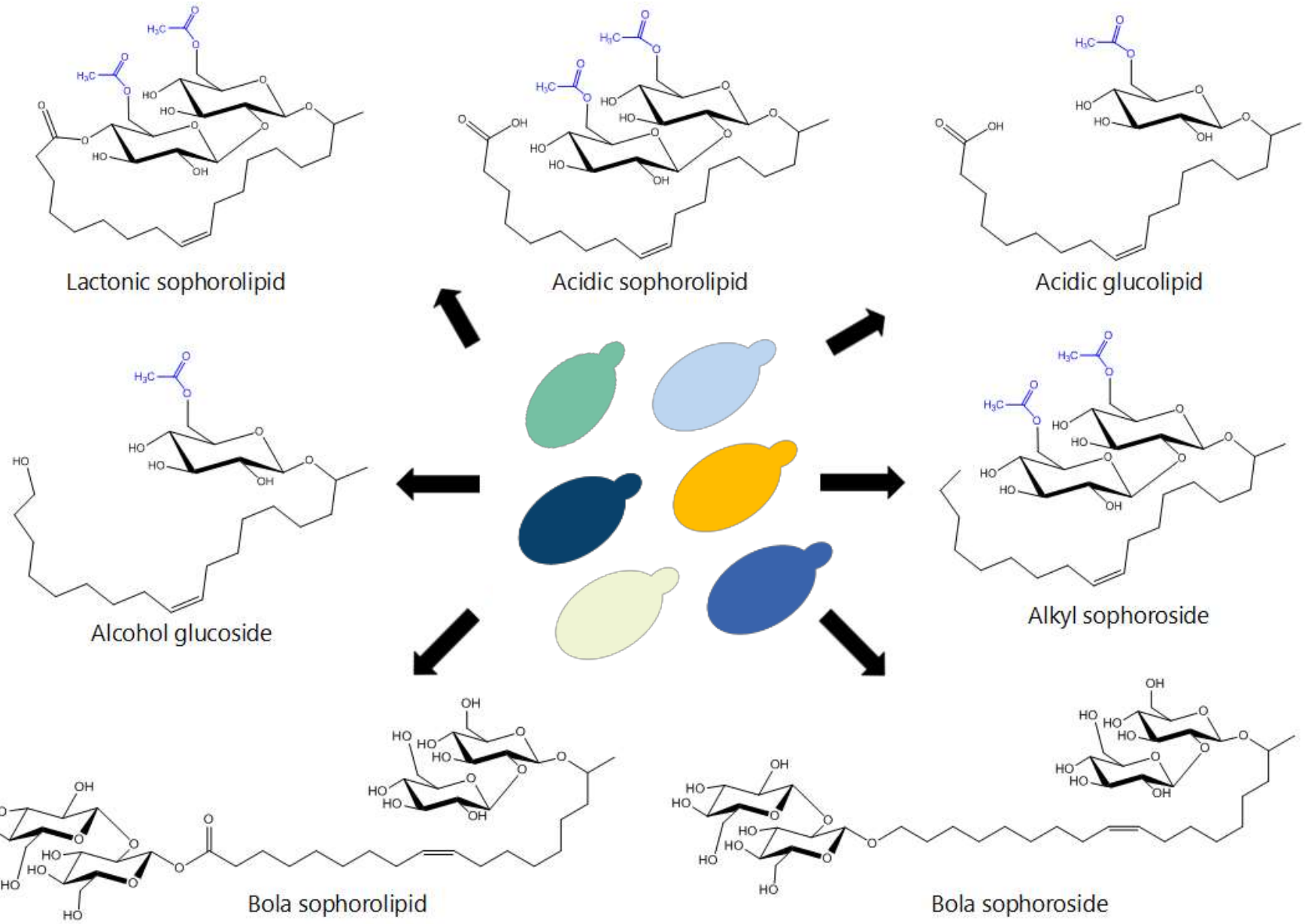
INCREASE

- Variety
- Uniformity
- Efficiency

03. Solving the bottlenecks

Genetic Engineering



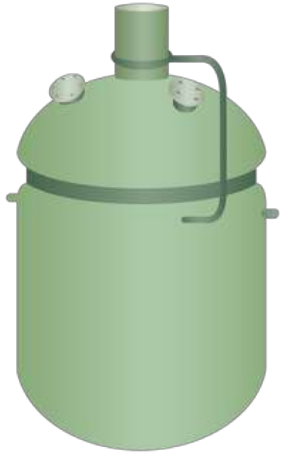


INCREASE

- Variety
- Uniformity
- Efficiency

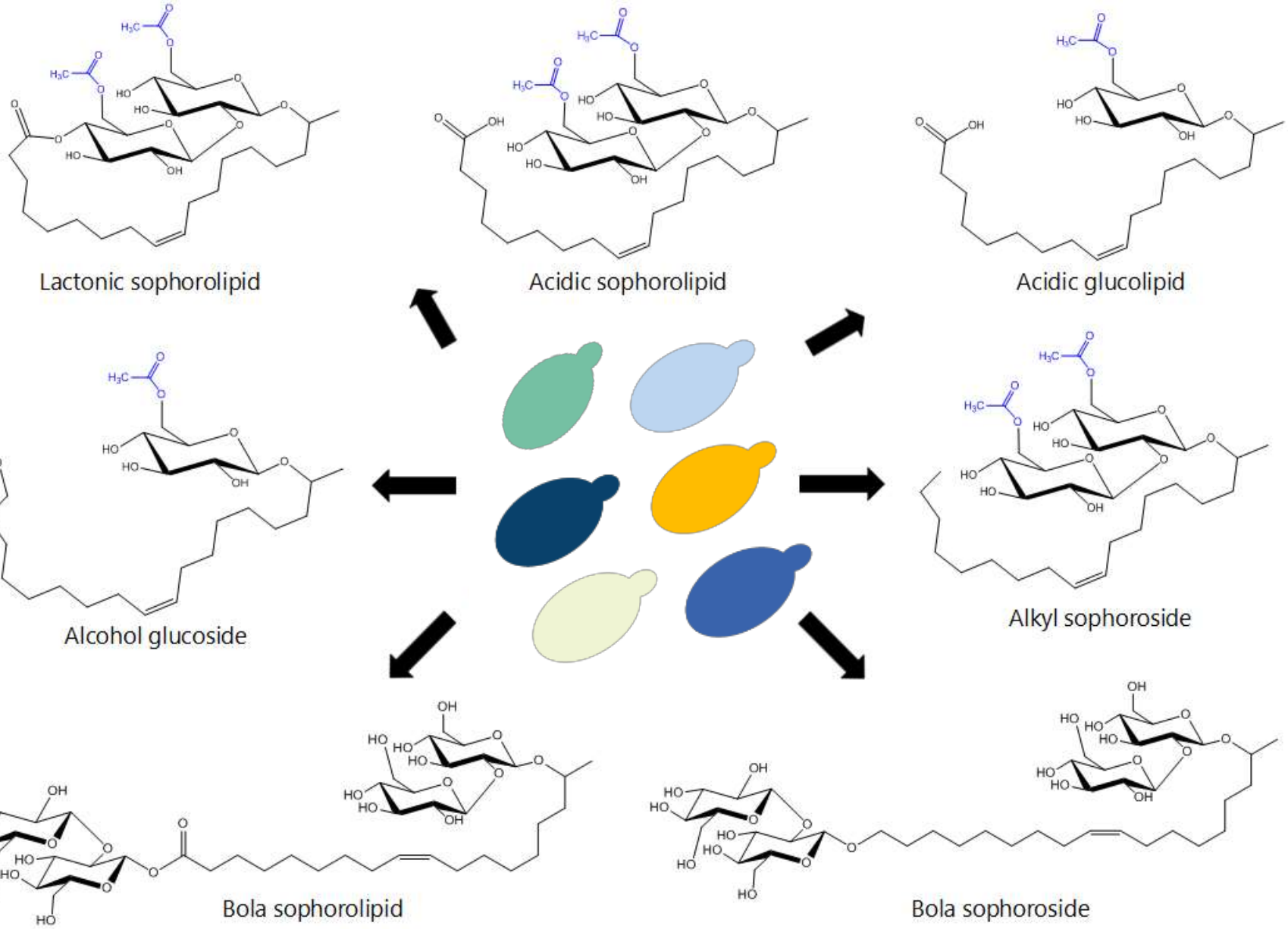
03. Solving the bottlenecks

Process development & scale up

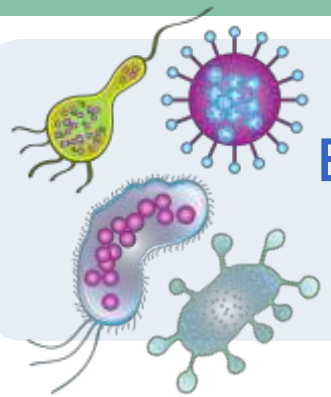


INCREASE

- Uniformity
- Purity
- Efficiency



Integrated process design -IPD- to bring IB to market



BIOCATALYST ENGINEERING ⟷ BIOCONVERSION ⟷ PURIFICATION (DSP)

SCALE UP

Application 1

Application 2

Application 3

Application 4

Application 5

03. AppliSurf: the approach

Microbial biosurfactant portfolio InBio.be & BBEPP:

⇒ **Opportunities**
- Increased (unique) variety
- Efficient production
- Toolboxes available for further development

⇒ **Bottlenecks**
- **Variety still limited**
- **Products not available**
- **No or little product information available**
- **No directed development possible due to lack of knowledge**

→ AppliSurf!

03. AppliSurf project

Join the Industry User Group Today!

http://www.fbbv.be/en/registration-industry-user-group-applisurf-project

Sophie.Roelants@bbeu.org

Thank you!

Bio Base Europe Pilot Plant

INBIO MICROBES AT WORK

GHENT UNIVERSITY GLOBAL CAMPUS

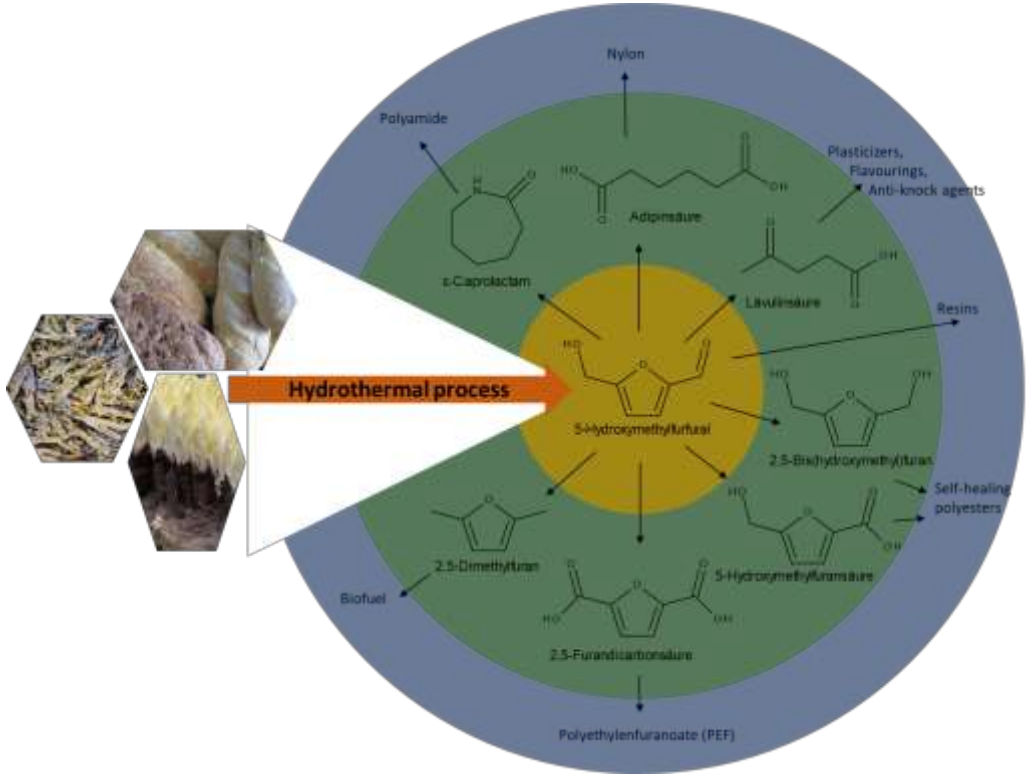
Hydroxymethylfurfural (HMF) from organic residues

Paul Körner

Konversions Technologien

Fossil Resources

Organic residues

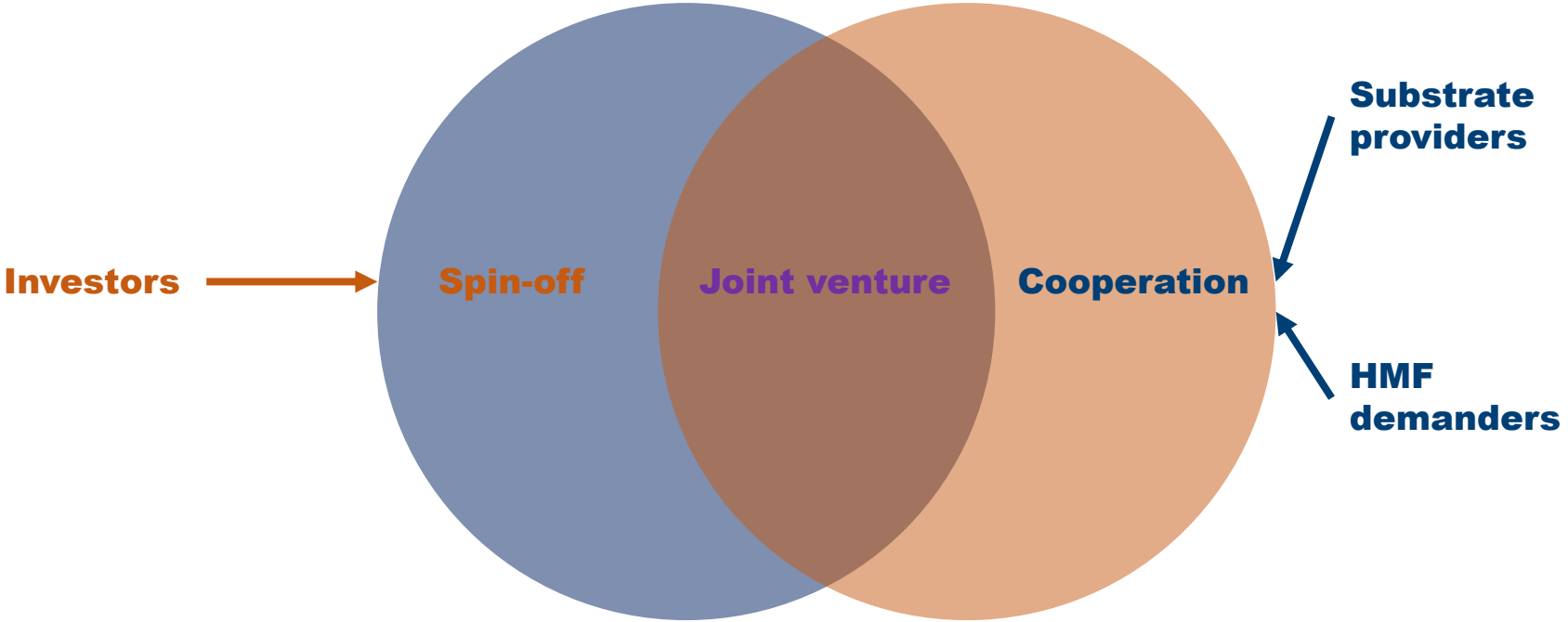


HMF = platform chemical
= formed by the dehydration of hexoses (carbohydrates)

“Nylon from Chicory”

Research station “Unterer Lindenhof”
location of Biorefinery Technikum

Our aims and needs



The team

Our competences:

- **Platform chemicals**
  - HMF
  - Phenols
  - Furfural
- **Hydrothermal carbonisation (HTC)**
  - Hydrochar
  - Activated char
  - Electrodes for supercapacitors
  - Direct carbon fuel cells
- **Pyrolysis**
- **Nutrient recycling**
  - Phosphate from sewage sludge or manure
- **Extraction processes**
  - Valuable products from algae

150 Jahre culture of excellence

Designed (Agro)chemicals Produced in Cells

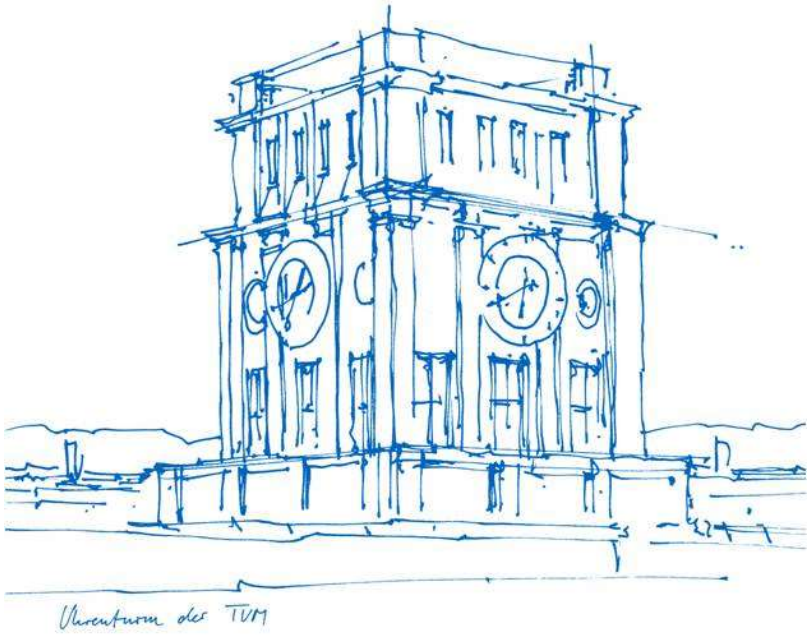
Monika Fuchs

Technische Universität München

Department of Chemistry

Chair of Synthetic Biotechnology

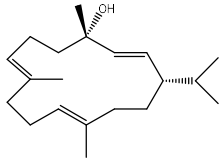
Brussles, 07.11.2018



WSSB
Werner Siemens-Lehrstuhl für
Synthetische Biotechnologie

Sustainable Terpenoids vs Extraction from Natrual Sources

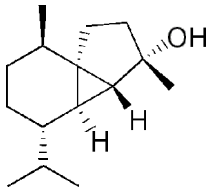
Nicotiana sylvestirs
woodland Tabacco



α-Cembrantrien-ol

Insect deterrent

Piper cubeba
Tailed pepper

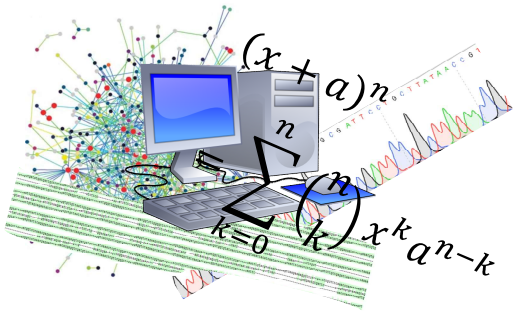


Cubebol

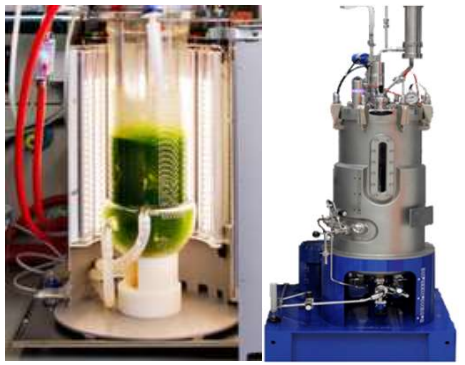
Potent cooling agent / insect deterrent

WSSB
Werner Siemens-Lehrstuhl für
Synthetische Biotechnologie

Bioinformatics

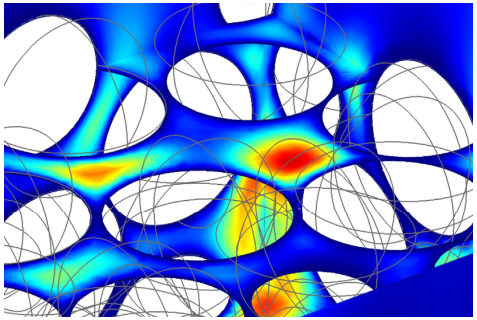


Bioprocess Engineering

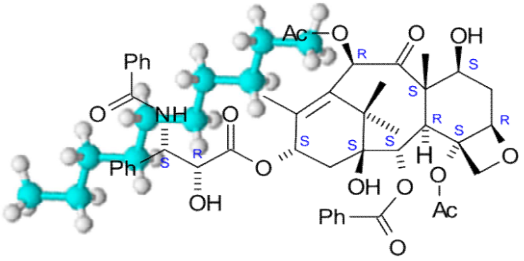


Synthetic Biotechnology

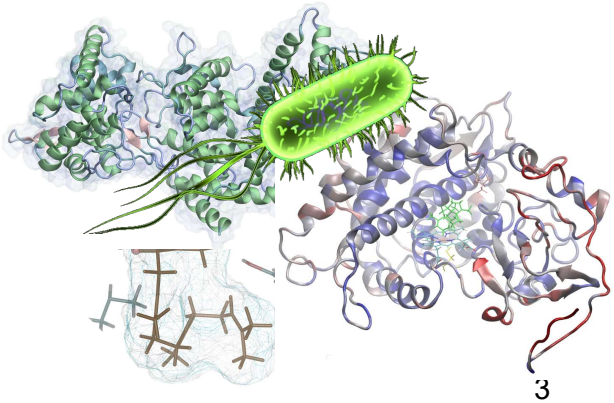
Systems Biotechnology



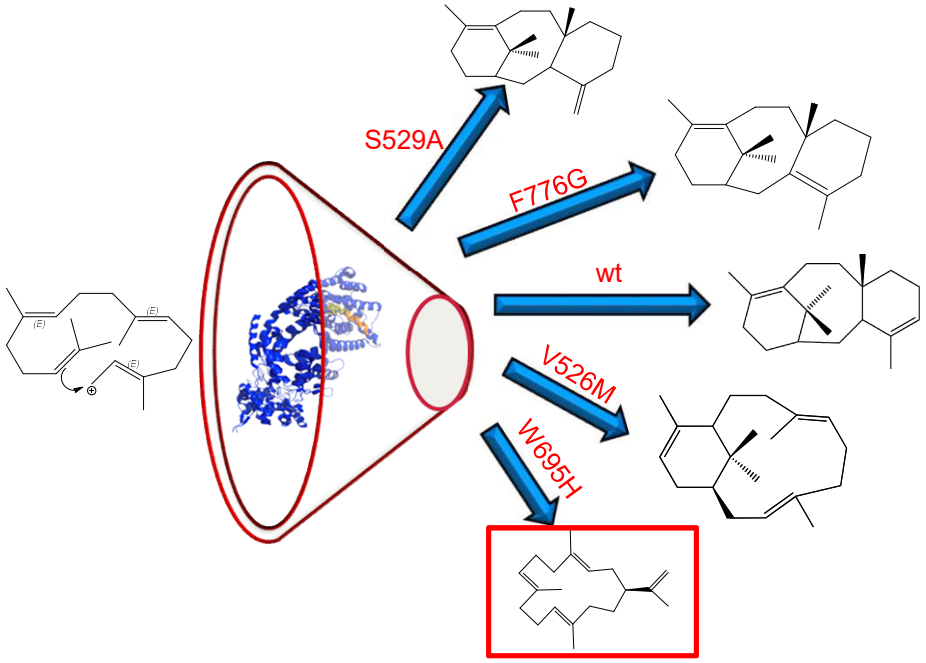
Chemistry

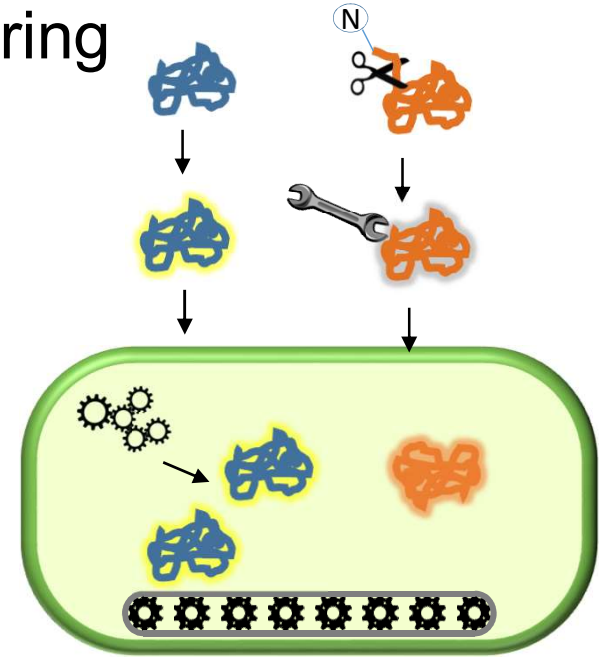


Biocatalyst Engineering

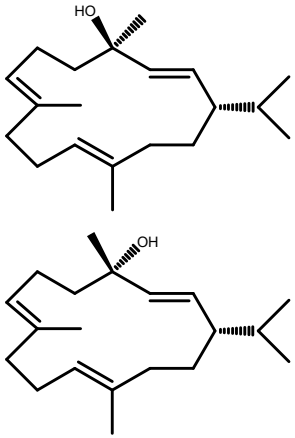


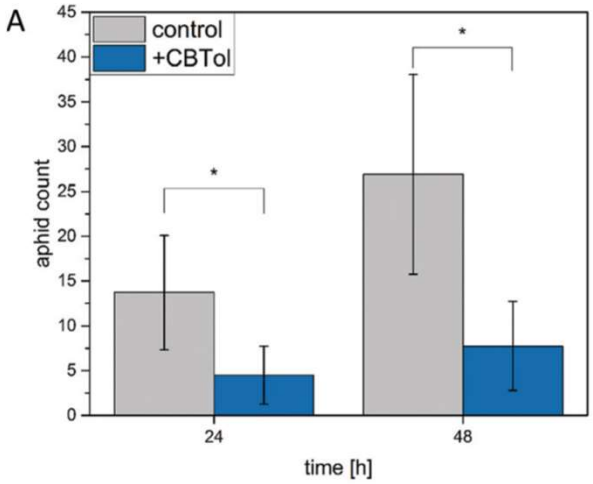
Enzyme engineering - Host engineering

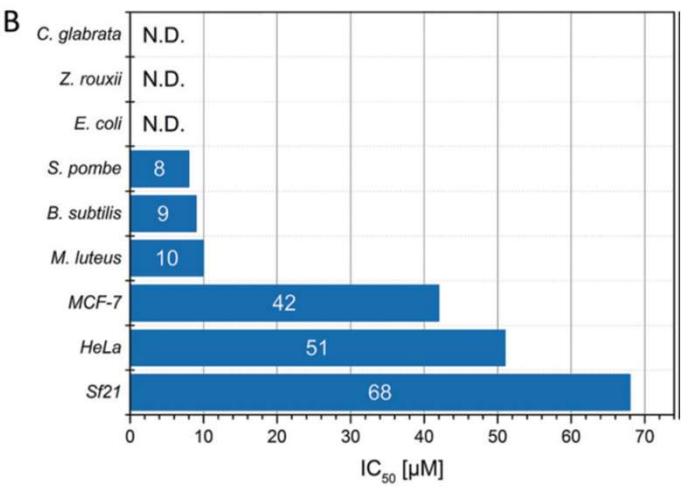




Cembrantriene-ol - Insect deterrents

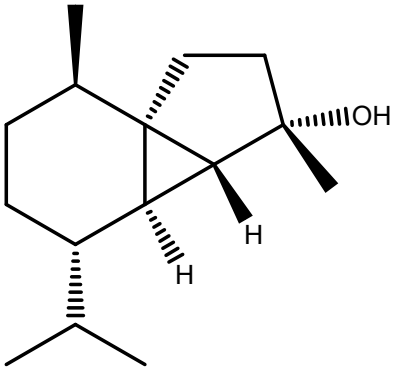






Mischko, W., M. Hirte, S. Roehrer, H. Engelhardt, N. Mehlmer, M. Minceva and T. Brück (2018). "Modular biomanufacturing for a sustainable production of terpenoid-based insect deterrents." Green Chemistry

Cubebol – Cooling Agent



Mischko, W., M. Hirte, M. Fuchs, N. Mehlmer and T. B. Bruck (2018). "Identification of sesquiterpene synthases from the Basidiomycota Coniophora puteana for the efficient and highly selective beta-copaene and cubebol production in E. coli." Microb Cell Fact **17**(1): 164.