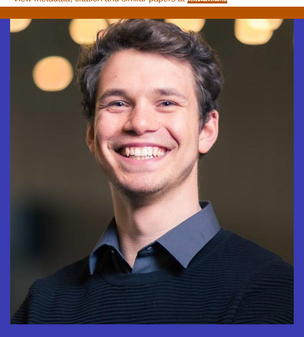


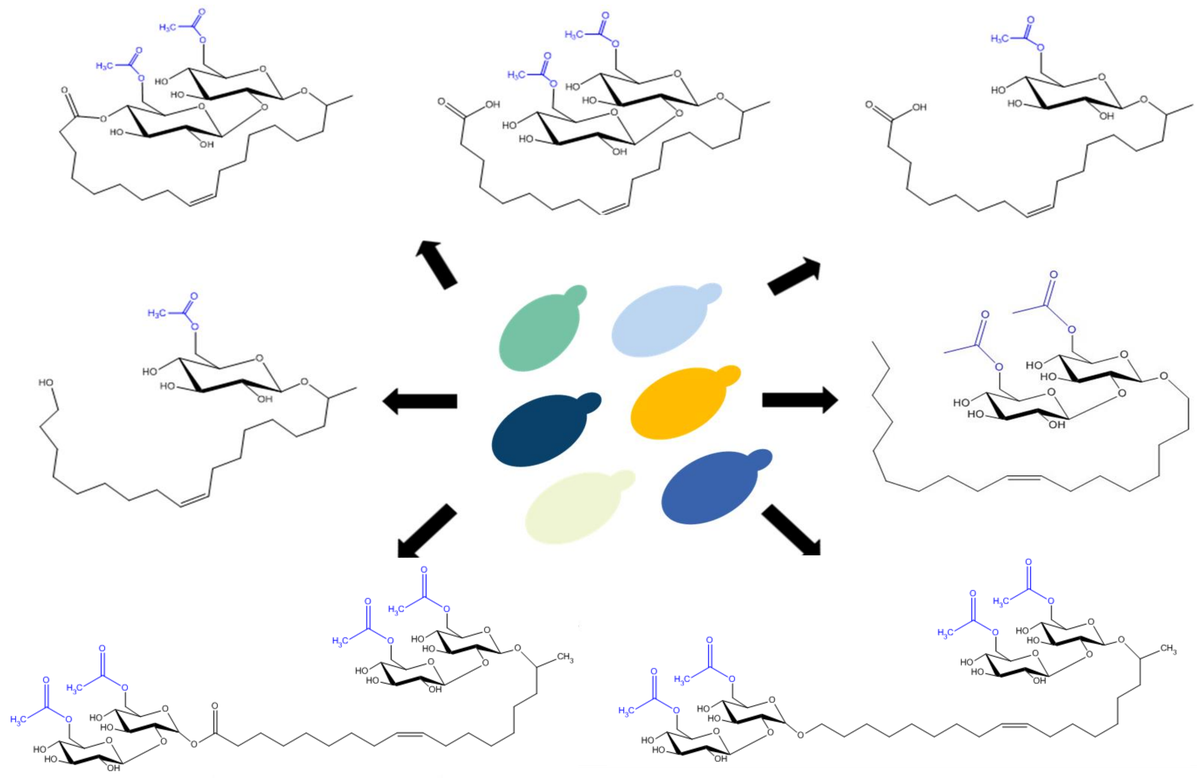
A microbial assay of novel glycolipid biosurfactants produced by the yeast *Starmerella bombicola*

M. Castelein[1], S. Roelants[1], L. Van Renterghem[1], E. Debonne[2], F. Devlieghere[2], W. Soetaert[1]

[1] Centre for Industrial Biotechnology and Biocatalysis (InBio.be), Faculty of Bioscience Engineering, Ghent University, Belgium
[2]Department of Food technology, Safety and Health, Faculty of Bioscience Engineering, Ghent University, Belgium

Introduction

The nonconventional yeast ***Starmerella bombicola*** is widely known for the production of promising bio-based glycolipid surfactants, which are gaining interest as a sustainable and environmentally friendly alternative to petroleum derived or oleochemical surfactants. However, limited structural variability hampers straightforward valorisation of these compounds. To meet the requirements regarding compound variability, InBio invested significant efforts to develop a battery of new *S. bombicola* strains producing **new-to-nature glycolipid biosurfactants**. As currently more of these novel compounds are produced on a larger scale, time has come to **map their properties** and associated application potential.



Glycolipids can display added value in terms of **pre- or antibiotic activity** [1], which is a desired aspect for different sectors (cosmetics, food industry, agro-industry etc.). Luckily, the diverse nature of the growing portfolio enables a range of microbial features that suits all needs. In the context of the AppliSurf project, in-depth information on biological properties of the glycolipid portfolio is investigated.

Strategy and methods

Antimicrobial tests are executed for all glycolipid biosurfactants and derivatives [2] present in the portfolio according to an agar or broth dilution method. Effects are evaluated against a selection of multiple industrially relevant microorganisms (Gram-positive and Gram-negative bacteria, yeasts, multicellular fungi) through a three-step approach.

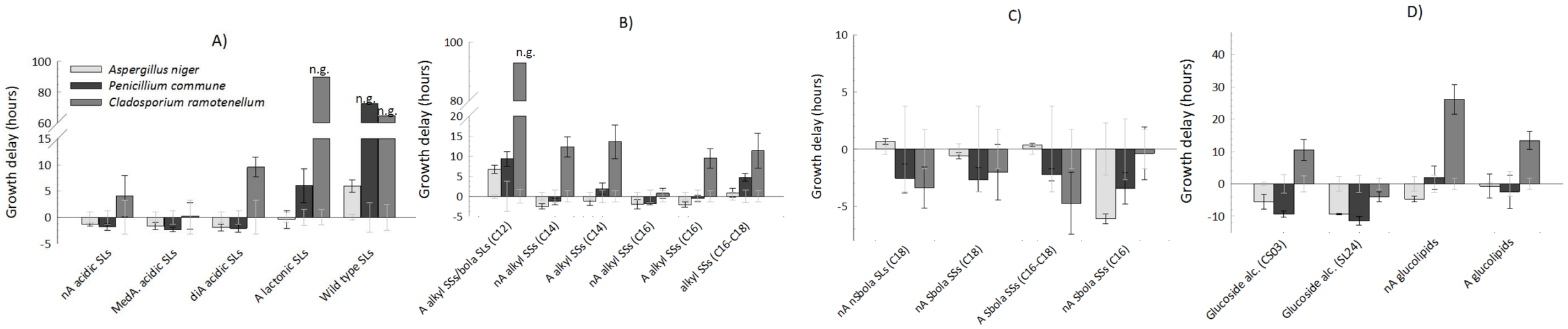
Step 1: preliminary screening
- Biosurfactant portfolio
- Set of organisms

→ Delayed/reduced growth combinations

Step 2: characterisation
- MIC/MLC determination
- CLSI Standards

Step 3: modelling
- Structure-function relations
- Predictions

Results



Growth delay (h) for *A. niger, P. commune* and *C. ramotenellum* in presence of wild type SLs (A), alkyl SSs (B), bolaform SLs/SSs (C) and alcohol GS and GLs (D). Growth delay on Y-axis (h) was calculated via the time to detection (TTD) for growth of the fungal strains. The time to detection is the time needed for growth to be observed. Positive values for growth delay indicate growth delay in presence of the BS, while negative values indicate growth stimulation in presence of the BS in comparison with the negative control (without BS added). Standard deviations are used as error: black bars for the BS containing experiments, grey bars for the negative control without BS.. A = acetylated, nA = non-acetylated, Sbola = symmetrical bolaform, nSbola = non- symmetrical bolaform, alc = alcohol, SS = sophoroside, SL = sophorolipid. Combinations with 'n.g.' above the bars are experiments that were stopped before any growth was observed.

Antifungal properties were determined for the full BS portfolio (19 BSs) at a concentration of 1 mM (≈ 0,5-1 g/L) on three food-spoiling fungi: *Cladosporium ramotenellum, Penicillium commune* and *Aspergillus niger*.

- *C. ramotenellum* proved to be most sensitive towards BSs
- Best results for wild type SLs (mixture of acidic and lactonic SLs) and C12:0 SSs (mixture of alkyl and bolaform SSs)
- The shorter the hydrophobic carbon chain, the bigger the growth delay effect for alkyl SSs for *C. ramotenellum*
- Non-acetylated GL showed antifungal effects for *C. ramotenellum*

References

[1] Elshikh, M, I Moya-Ramírez, H Moens, et al. "Rhamnolipids and Lactonic Sophorolipids : Natural Antimicrobial Surfactants for Oral Hygiene." *JOURNAL OF APPLIED MICROBIOLOGY* 123.5 (2017): 1111–1123.
[2] Delbeke, Elisabeth et al. "Lipid-based Quaternary Ammonium Sophorolipid Amphiphiles with Antimicrobial and Transfection Activities." *CHEMSUSCHEM* 12.5 (2019): 3642–3653.

Acknowledgements

Supported by AppliSurf, a cluster-VIS project

Address: Faculty of Bioscience Engineering, Coupure Links 653, Ghent (Belgium)
E-mail: martijn.castelein@ugent.be