Candida lignohabitans for organic acid production from lignocellulosic material

Martina Bellasio[1], Hans Marx[1], Diethard Mattanovich[1,2] and Michael Sauer[1,2]

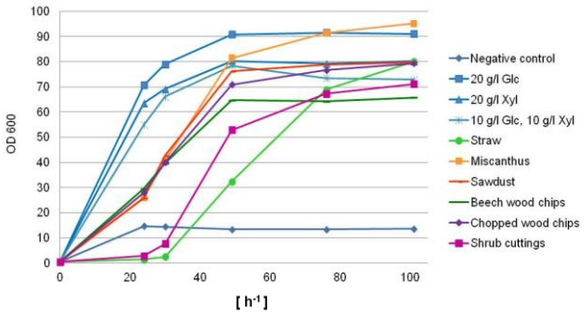
1. Department of Biotechnology, BOKU – VIBT University of Natural Resources and Life Sciences, Vienna, Austria
2. Austrian Centre of Industrial Biotechnology (ACIB GmbH), Vienna, Austria

Correspondence: martina.bellasio@boku.ac.at

University of Natural Resources and Life Sciences, Vienna
Department of Biotechnology

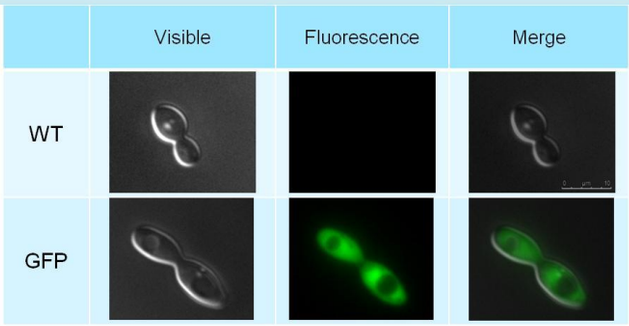
Microbial conversion of lignocellulosic biomass is based on microbial cell factories, which efficienty use hexose and pentose sugars, liberated from pretreated feedstocks, to produce the desired compounds.
The capability of the yeast *Candida lignohabitans* to grow using pretreated lignocellulosic material was assessed. Genetically engineered *C. lignohabitans* strains have proven to produce significant amounts of value-added chemicals, both during the growth on pure sugars and on enzymatic hydrolysates.

Characterization and genetic engineering



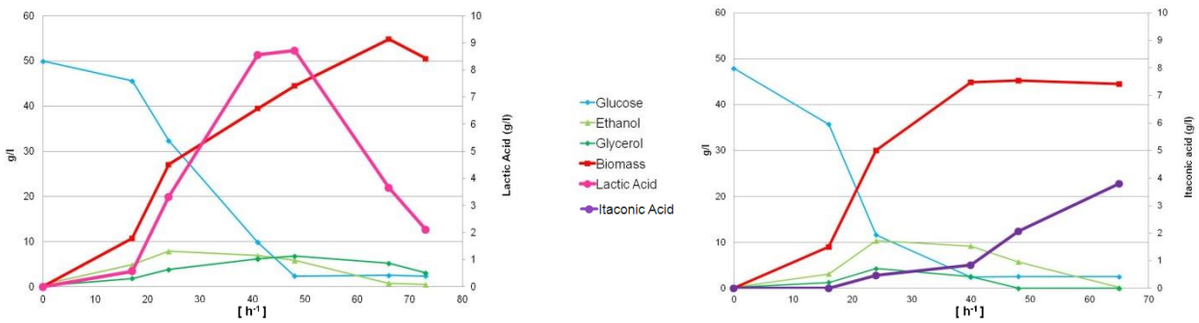
Growth of *C. lignohabitans* in medium supplemented with hydrolysed lignocellulosic material as carbon source (20 g/l).
A variety of lignocellulosic biomass was pretreated by steam explosion and enzymatically digested. The yeast is able to grow on sugars present in all the types of digested lignocellulosic material. The data suggest different amounts of inhibitory componds in the hydrolysates derived from different feedstocks.

We developed a transformation protocol for *C. lignohabitans*, which has proven to be a yeast not belonging to the CTG clade. The endogenous GAP (glyceraldehyde 3-phosphate dehydrogenase) promoter was isolated from the genomic DNA with an inverse PCR technique. In the figure below, GFP expression under the control of the endogenous GAP promoter is shown.

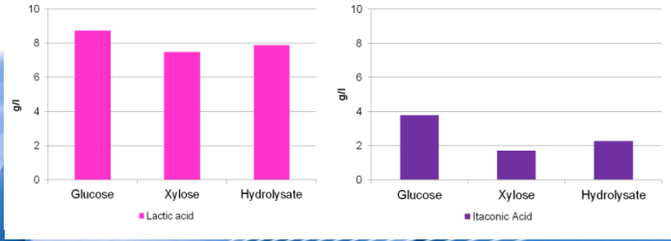


Organic acid production

C. lignohabitans was genetically engineered to allow the production of **lactic acid** and **itaconic acid**, as examples for value added chemicals of interest.

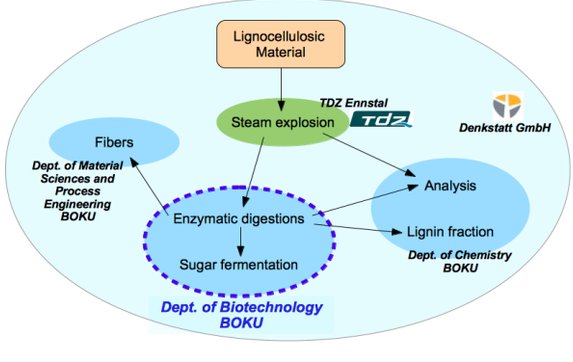


Metabolites and biomass production during liquid cultures with engineered strains is showed in the diagrams above.
Below, a comparison between the production of lactic and itaconic acid from pure glucose and xylose and from enzymatic hydrolysates.
The carbon source doesn't greatly influence the production of organic acids.



The project

This project is part of a research program of a consortium of five parties:
Dept. of Biotechnology, Dept. of Chemistry, Dept. of Material sciences and Process Engineering of **BOKU**, the Technology and Service Center (TDZ) Ennstal, and Denkstatt GmbH.
The division of tasks is represented in the scheme below.
The project is financed by FFG Austria programme "Intelligente Produktion".



***Candida lignohabitans* efficiently converts sugars derived from lignocellulosic material into compounds of interest, such as lactic acid and itaconic acid.**

These features make *C. lignohabitans* an interesting microbial cell factory for biorefinery purposes.