Malic acid production from glycerol with *Ustilago trichophora*

Nick Wierckx

Institute of Applied Microbiology, RWTH Aachen University, Aachen, Germany

Contact: nick.wierckx@rwth-aachen.de

The rising production of biodiesel is accompanied by the production of a huge amount of glycerol, which is, with 10 %(w/v), the main low-value byproduct. Hence, the valorization of this large waste stream is considered a high priority in order to make the overall biodiesel refinery economically and ecologically feasible. One approach is the microbial conversion of crude glycerol to value-added chemicals.

To this end, we screened 76 *Ustilaginaceae* for conversion of glycerol to organic acids. This fungal family is known to produce organic acids naturally at high titers, rates and yields (1). *Ustilago trichophora* was found to efficiently produce malic acid from glycerol naturally with little byproducts. Malic acid is a promising bio-based chemical, currently mainly used as acidulant in foods and beverages. However, it also has a great potential as bio-based building block with a wide range of applications including polymers, pharmaceuticals and solvents (2). The glycerol uptake rate of *U. trichophora* is relatively low. By evolutionary engineering, the growth and production rates were increased by 2.5-fold and 6.6-fold, respectively. For economically feasible production of malic acid that can compete with existing production processes, high titers, yields and rates are required. Further medium and fermentation process optimization increased the overall production rate to 0.74 g/l/h with a maximum production rate of 1.5 g/l/h reaching a titer of 195 g/l. This titer is the highest reported for the microbial production of malic acid so far, making *U. trichophora* a promising microbial production host for the valorization of biodiesel-associated glycerol.

References

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