Redirecting the lipid metabolism of *Starmerella bombicola* from glycolipids to free fatty acid production

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Free fatty acids are basic oleochemicals implemented in a range of applications including surfactants, lubricants, paints, surface coatings, plastics, and cosmetics. Due to a limited global supply of petroleum and newly developed energy security strategies, microbial fatty acid biosynthesis has gained much attention as it provides a sustainable alternative for petrol- and plant oil- derived chemicals. Beside oleaginous microorganisms, *Starmerella bombicola* is another microbial cell-factory that possesses a powerful lipid metabolism. Yet, this yeast species deploys its capacities for the production of industrially relevant compounds such as the biodetergent sophorolipids (>300 g/L).

We aimed to exploit the lipidic potential of *S. bombicola* and converted it from the glycolipid production platform into a free fatty acid cell factory. We used several metabolic engineering strategies to promote extracellular fatty acid synthesis which include blocking competing pathways (glycolipid biosynthesis and β-oxidation), preventing free fatty acid activation, and increasing the cytosolic acetyl-CoA pool. The best producing mutant (Δcyp52m1Δfaa1Δmfe2) secreted 0.933g/L (±0.04) free fatty acids with a majority of C18:1 (43.8%) followed by C18:0 and C16:0 (40.0 and 13.2% respectively). Interestingly, some of the modifications applied to create a free fatty acid producing cell-factory proved to be useful as well to increase *de novo* sophorolipid synthesis. The overall concentration of glycolipids secreted by the mutant during the shake flask experiment was over 20% higher in comparison to the control strain ($p = 0.0054$).

We believe that our work is pivotal for the further development and exploration of *S. bombicola* as a platform for synthesis of environmentally friendly oleochemicals.