BRC Science Highlight
October 2021

Metabolic Engineering of the Oleaginous Yeast *Yarrowia lipolytica* PO1f for Production of Erythritol from Glycerol

Background/objective

Sugar alcohols are widely used as low-calorie sweeteners in the food industry and can also be transformed into platform chemicals. *Yarrowia lipolytica*, an oleaginous yeast, is a promising host for producing many sugar alcohols. In this work we tested whether heterologous expression of a recently identified sugar alcohol phosphatase (PYP) from *Saccharomyces cerevisiae* and overexpression the pentose pathway genes would increase sugar alcohol production using pure and crude glycerol in *Y. lipolytica*.

Approach

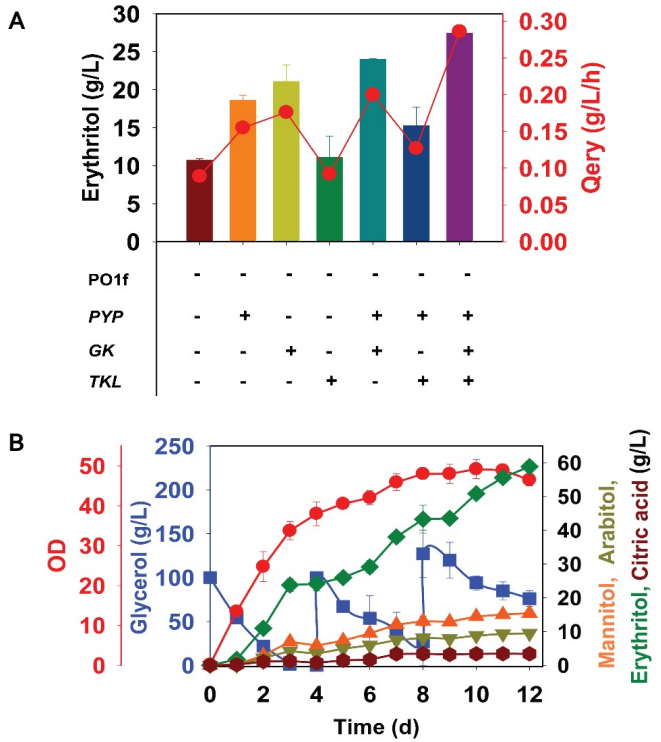
- *Y. lipolytica* was first tested to determine if it natively produces sugar alcohols during growth on different substrates.
- To better understand the effect of osmotic stress on erythritol production from glycerol, the expression of key genes and intracellular metabolites was measured using metabolomics.
- The effect of the combined overexpression of *S. cerevisiae* PYP with native pentose phosphate pathway genes on erythritol titer and glycerol utilization in batch and fed-batch growth was also tested.

Results

- Osmotic stress induced production of erythritol in *Y. lipolytica* and upregulated several key genes from both the pentose phosphate and glycerol catabolic pathways.
- Osmotic stress also increased the production of sugar alcohols, polyamines, and amino acids.
- The combined overexpression of sugar alcohol phosphatase and pentose phosphate pathways genes increased both pure and crude glycerol utilization rates and erythritol titers in batch and fed-batch growth.

Significance

This work establishes a new route for increasing sugar alcohol production and further develops *Y. lipolytica* as a promising host for erythritol production from relatively inexpensive substrates such as glycerol.



Erythritol titers and productivities for engineered strains of *Y. lipolytica* PO1f on glycerol (100 g/L) during (A) batch and (B) fed-batch culture using PO1f-PYP-GK-TKL.

Jagtap S.S., et al. 2021. "Metabolic Engineering of the Oleaginous Yeast Yarrowia Lipolytica PO1f for Production of Erythritol from Glycerol." ***Biotechnology for Biofuels*** *14,188. DOI: 10.1186/s13068-021-02039-0.*

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