Engineering of synthetic, stress-responsive yeast promoters - DTU Orbit (09/01/2019)

Engineering of synthetic, stress-responsive yeast promoters

Advances in synthetic biology and our understanding of the rules of promoter architecture have led to the development of diverse synthetic constitutive and inducible promoters in eukaryotes and prokaryotes. However, the design of promoters inducible by specific endogenous or environmental conditions is still rarely undertaken. In this study, we engineered and characterized a set of strong, synthetic promoters for budding yeast *Saccharomyces cerevisiae* that are inducible under acidic conditions (pH ≤ 3). Using available expression and transcription factor binding data, literature on transcriptional regulation, and known rules of promoter architecture we improved the low-pH performance of the YGP1 promoter by modifying transcription factor binding sites in its upstream activation sequence. The engineering strategy outlined for the YGP1 promoter was subsequently applied to create a response to low pH in the unrelated CCW14 promoter. We applied our best promoter variants to low-pH fermentations, enabling tenfold increased production of lactic acid compared to titres obtained with the commonly used, native TEF1 promoter. Our findings outline and validate a general strategy to iteratively design and engineer synthetic yeast promoters inducible to environmental conditions or stresses of interest.

General information

State: Published
Organisations: Novo Nordisk Foundation Center for Biosustainability, Synthetic Biology Tools for Yeast, iLoop, Yeast Cell Factories, Chalmers University of Technology
Number of pages: 12
Publication date: 2016
Peer-reviewed: Yes