Anaerobic α-Amylase Production and Secretion with Fumarate as the Final Electron Acceptor in Saccharomyces cerevisiae - DTU Orbit (30/12/2018)

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In this study, we focus on production of heterologous α-amylase in the yeast Saccharomyces cerevisiae under anaerobic conditions. We compare the metabolic fluxes and transcriptional regulation under aerobic and anaerobic conditions, with the objective of identifying the final electron acceptor for protein folding under anaerobic conditions. We find that yeast produces more amylase under anaerobic conditions than under aerobic conditions, and we propose a model for electron transfer under anaerobic conditions. According to our model, during protein folding the electrons from the endoplasmic reticulum are transferred to fumarate as the final electron acceptor. This model is supported by findings that the addition of fumarate under anaerobic (but not aerobic) conditions improves cell growth, specifically in the α-amylase-producing strain, in which it is not used as a carbon source. Our results provide a model for the molecular mechanism of anaerobic protein secretion using fumarate as the final electron acceptor, which may allow for further engineering of yeast for improved protein secretion under anaerobic growth conditions.

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