Modeling and design of synthetic metabolic pathways

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SynBio project:

The project SynBio aims at the fundamentals of Synthetic Biology for the development of novel synthetic biological systems for the production of fine chemicals or bioenergy. One of the model systems involved is a high yield *in vitro* synthetic pathway (a multi-step system involving 13 enzymes and 19 intermediates) for production of hydrogen from sustainable biomass with high efficiency and great potential (Fig. 1, modified from Zhang et al. 2007).

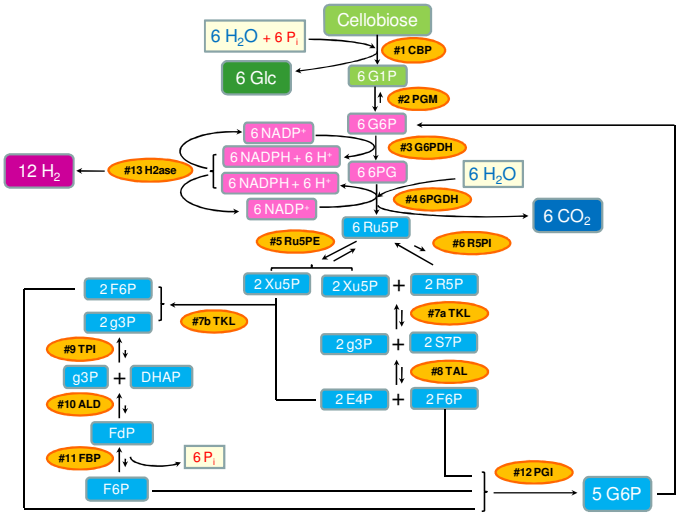

Fig. 1: High yield *in vitro* synthetic pathway for hydrogen production

Work package 1:

Work-package 1 is focused on the development of mathematical models for quantitative and dynamic analysis of the synthetic pathway for H_2 production. The models proposed are used for the simulation of different process configurations and conditions with the goal of maximizing the volumetric productivity of hydrogen and yield. The simulation and process optimization is performed with MATLAB software (Fig. 2). Several reactor configurations, comprising ideal continuous stirred tank reactors and plug flow reactors operated in series, parallel and with recirculation; and different distributions of the 13 enzymes of the pathway are assessed in order to obtain the most suitable configuration for the production of hydrogen by means of the proposed synthetic pathway.

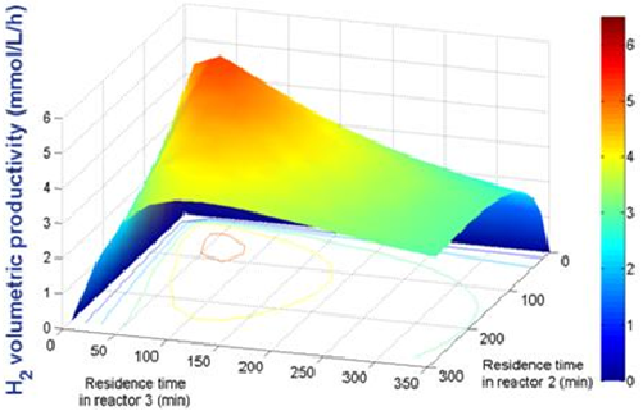

Fig. 2: Simulated performance of a series of three bioreactors with recycling

References

Y.-H.P. Zhang et al. (2007) High-Yield hydrogen production from starch and water by a synthetic enzymatic pathway. Plos ONE, 2(5), e456

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