DEVELOPMENT OF ENZYME AND WHOLE CELL BIOCATALYST FOR PRODUCTION OF OPTICALLY ACTIVE COMPOUNDS

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PHD THESIS SUMMARY

The goal of my PhD was to develop efficient biocatalytic system for production of optically active compounds. We designed a new cost-effective sol-gel immobilization of whole-cells from broth by avoiding lyophilization and further purification. This process provide integrated biocatalysts of good storability and operational stability. We demonstrated the multifaceted biocatalytic activity of microbial whole cells was preserved by sol-gel entrapment of yeast cells. The immobilized whole cells have successfully applied as multipurpose "on-demand switchable" biocatalysts which could mediate both enantiotope selective bioreduction and acyloin condensation effectively. We designed a sol-gel process for co-immobilization of whole-cells of *E. coli* with *Chromobacterium violaceum* ω-transaminase activity and *Lodderomyces elongisporus* with ketoreductase activity. The co-immobilized cells were successfully applied in the biocatalytic cascade system for synthesis of chiral compounds (amines and alcohols) in batch and continuous-flow mode. We demonstrated that the various mesoporous surface grafted silica gels proved to be efficient supports for the adsorptive immobilization of lipases from *Rhizomucor miehei* (*Rm*L) and *Thermomyces lanuginosus* (*Tl*L) influencing significantly the activity of the resulting biocatalysts in the kinetic resolution of alcohols.

Five relevant publications:

1. V. Bódai, L. Nagy-Győr, R. Örkényi, Zs. Molnár, Sz. Kohári, B. Erdélyi, Zs. Nagymáté, Cs. Romsics, Cs. Paizs, ,L. Poppe, G. Hornyánszky: *Wickerhamomyces subpelliculosus* as whole-cell biocatalyst for stereoselective bioreduction of ketones, *Journal of Molecular Catalys B: Enzymatic*, **2016**, *134*, 206–214 (IF: 2,269, contribution by author: 80%)
2. L. Nagy-Győr, E. Abaházi, V. Bódai, P. Sátorhelyi, B. Erdélyi, D. Balogh-Weiser, Cs. Paizs, G. Hornyánszky, L. Poppe: Co-immobilized whole-cells with ω-transaminase and ketoreductase activity for continuous-flow cascade reaction, *ChemBioChem*, **2018**, *19*, 1845–1848. (IF: 2,774, contribution by author: 51%)
3. L. Nagy-Győr, E. Farkas, G. Tóth, D. Incze, G. Hornyánszky, L. Poppe, D. Balogh-Weiser: Conversation of the biocatalytic activity of whole-cells – 2nd generation sol-gel entrapment of yeast for sustainable acyloin condensation, *Periodica Polytechnica – Chemical Engineering*, **2019**, DOI: 10.3311/PPch.14645, (IF: 1,382, contribution by author: 55%)
4. L. Nagy-Győr, M. Lacatus, D. Balogh-Weiser, P. Csuka, V. Bódai, B. Erdélyi, Zs. Molnár, G. Hornyánszky, Cs. Paizs, L. Poppe: How to turn yeast cells into sustainable and switchable biocatalyst? On-demand catalysis of ketone bioreduction or acyloin condensation, *ACS Sustainable Chemistry & Engineering*, **2019**, DOI:10.1021/acssuschemeng.9b03367, IF: 6,97, contribution by the author: 60%
5. L. Nagy-Győr, Z. Boros, L. Poppe: Immobilization of lipases from *Rhizomucor miehei* and *Thermomyces lanuginosus* by adsorption on variosuly grafted silica gels, *Periodica Polytechnica – Chemical Engineering*, **2013**, *57*, 37–40 (IF: 0,130, contribution by author: 95%)