Journal of Flow Chemistry **2016**, 43-52

Microfluidic multiple cell chip reactor filled with enzyme-coated magnetic nanoparticles – An efficient and flexible novel tool for enzyme catalyzed biotransformations

Ferenc Ender, Diána Weiser, Botond Nagy, Csaba László Bencze, Csaba Paizs, Péter Pálovics and László Poppe

ABSTRACT

Biotransformation of L-phenylalanine (L-**1a**) and five unnatural substrates (*rac*-**1b-f**) by phenylalanine ammonia-lyase (PAL) was investigated in a novel microfluidic device (Magne-Chip) comprises microliter volume reaction cells filled with PAL-coated magnetic nanoparticles (MNPs). Experiments proved the excellent reproducibility of enzyme-catalyzed biotransformation in the chip and the excellent reusability of the enzyme layer during 14 h continuous measurement (>98% over 7 repetitive measurements with L-**1a**). The platform also enabled fully automatic multi-parameter measurements with a single biocatalyst loading of about 1 mg PAL-MNP. Computational Fluid Dynamics (CFD) calculations were used to study the flow field in the chambers and the effect of unintended bubble formation. Optimal flow rate for L-**1a** reaction and specific activities for *rac*-**1b-f** under these conditions were determined.

Keywords: Magnetic nanoparticle, magnetic chip reactor, continuous-flow biotransformation, phenylalanine ammonia-lyase, unnatural amino acid