Submitted to ChemCatChem 2014

Immobilization of phenylalanine ammonia-lyase on single-walled carbon nanotubes for stereoselective biotransformations in batch and in continuous-flow modes

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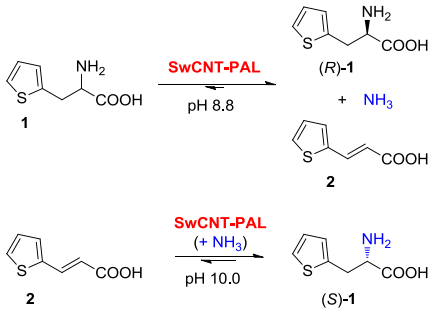
Abstract: Carboxylated single-walled carbon nanotubes ($SwCNT_{COOH}$) were tested as supports for covalent immobilization of phenylalanine ammonia-lyase (PAL) from *Petroselinum crispum.* $SwCNT_{COOH}$ decorated with PAL by two different methods ($SwCNT_{COOH}$-PAL^{I} and $SwCNT_{COOH}$-PAL^{II}) was studied in the kinetic resolution of racemic 2-amino-3-(thiophen-2-yl)propanoic acid **1** [yielding a mixture of (*R*)-**1** and (*E*)-3-(thiophen-2-yl)acrylic acid **2**] and in the ammonia addition onto **2** [yielding enantiopure (*S*)-**1**]. $SwCNT_{COOH}$-PAL^{II} was the most durable biocatalyst in batch mode ammonia elimination from **1** and addition to **2**, preserving over 90% of its original activity after 6 cycles in elimination or 3 cycles in addition (in 6 M NH_3) reactions. Ammonia addition onto **2** (in 2 M NH_3) was also investigated in continuous-flow packed-bed microreactors filled with $SwCNT_{COOH}$-PAL^{II} in the 30-80 °C temperature and 1-15 bar pressure ranges. No significant loss of activity was observed in the microreactor up to 60 °C over 72 h.



SwCNT-PALs for ammonia elimination from 2-amino-3-(thiophen-2-yl)propanoic acid **1** and ammonia addition to 3-(thiophen-2-yl)acrylic acid **2**.

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