Highly Efficient Rh-catalysts Immobilised by π-π Stacking for the Asymmetric Hydroformylation of Norbornene under Continuous Flow Conditions

The application of C1-symmetrical diphosphite ligands containing furanose backbone in the Rh-catalysed asymmetric hydroformylation of norbornene is described. The catalysts were highly active and produced exclusively exo-norbornanecarboxaldehyde with enantioselectivities (ee) up to 71%. Considering these promising results, the ligands were modified with a pyrene moiety to accomplish their immobilisation onto carbon materials. The corresponding Rh complexes bearing the novel pyrene-tagged ligands were synthesised and immobilised onto multiwalled carbon nanotubes (MWCNT), reduced graphene oxide (rGO) and carbon beads (CBs). The novel catalytic systems were tested in the asymmetric hydroformylation of norbornene providing similar performance in terms of both activity and selectivity compared to the non-immobilised systems. The recyclability of the new heterogenised catalysts was studied in the target reaction in batch mode. Nevertheless, the recycling was unsuccessful due to catalyst leaching. When used under continuous flow mode, these catalysts revealed robust and provided even higher ee than the corresponding homogeneous systems.

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