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Manganese-salan complex immobilized on reduced graphene oxide: A recyclable catalyst for aerobic enantioselective epoxidation of olefins

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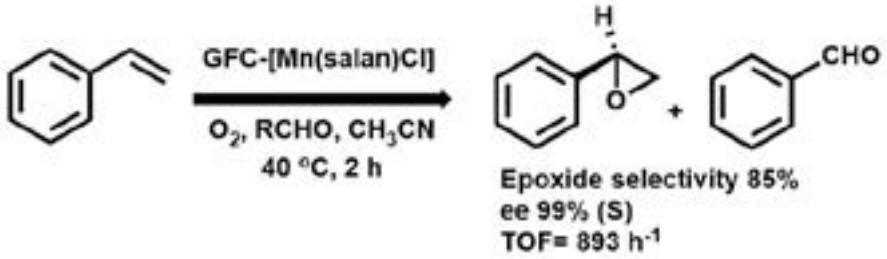
Chiral compounds are commonly required in pharma, agrochemical and fine chemical sectors. More importantly, there is a strong demand for the pure enantiomers in pharmaceutical industry. Various desirable chiral products can be synthesized using chiral epoxides by stereospecific ring-opening reactions. Catalytic asymmetric oxidation of olefins by various oxygen donors can be used to prepare chiral epoxides. From the point of view of green and sustainable chemistry, molecular oxygen is an ideal oxidant with regard to its natural, inexpensive and environmentally friendly characters. Salen (bis(salicylidene)ethylenediamine) and salan (N,N'-bis(o-hydroxybenzyl)-1,2-diaminocyclohexane) ligands are an important class of tetradentate dianionic ligands in the chemistry of transition metals. Chiral salans have been known as effective ligands for asymmetric synthesis because of their more flexibility which let to be modified easily with respect to salen ligands. Chiral salan compounds have been used as a fluorescent sensor for CuCl and salan-Cu complex for the selective recognition and discrimination of protected α-amino acids. In this study, a chiral Mn(III) complex of the reduced salen ligand (salen = (1R,2R)-(-)-(N,N'-bis(5-chloromethylsalicylidene)cyclohexane-diamine) was synthesized and covalently grafted onto carbon coated magnetic Fe_3O_4 nanoparticles decorated reduced graphene oxide sheets (GFC). The catalyst was characterized by FT-IR, UV/Vis, XRD, SEM and vibrating sample magnetometer (VSM) techniques. The synthesized GFC-[Mn(salan)Cl] was employed in the aerobic enantioselective epoxidation of non-functionalized olefins. The effects of reaction variables such as temperature, time and solvent on the catalytic performance were systematically investigated. The catalyst was found to be highly active and enantioselective for epoxidation of styrene (Scheme 1), alpha-methyl styrene and trans-stilbene. Catalyst GFC-[Mn(salan)Cl] is stable and could be recycled at least five times without loss of its catalytic activity.



Scheme 1: Catalytic oxidation of styrene with O_2.

Biography

Hassan Hosseini-Monfared has research focus on applied homogeneous and nanostructured heterogeneous catalysis, the development and application of new, environmentally benign catalysts, asymmetric catalysis and synthetic methods.

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