16e Hydrogenation of Amino Acid by Asymmetric Homogeneous Catalyst

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Abstract

The hydrogenation of an amino acid derivative to form a racemic mixture was carried out by use of a homogeneous catalyst DuPhos at room temperature and an elevated pressure. The reaction conversion is close to completion and the optical yield is over 99% enantiomeric excess. This reaction was successfully scaled up. However, developing a large scale process remains a challenge for requiring the molar substrate to catalyst ratio (S/C) to be greater than 1000 to make the process commercially viable.

In this application, catalytically active species in the turnover limiting step of the reaction is a substrate containing complex. The induction period is the time delay due to the formation of the catalyst from the pre-catalyst. The hydrogenation is far from complete as the catalyst loading is below the threshold. The mechanistic aspects of this reaction exhibits great interests. In our study, the reaction pathways have been explored. The kinetic model is established to describe the complex reaction networks –particular features including substrate poisoning, product inhibition, induction period and reaction environmental effects (temperature, pressure, acid and base) are included.