Abstract

Since 2000 the organocatalytic synthesis has developed massively in a third pillar of asymmetric synthesis standing next to catalysis with metal complexes and enzymatic catalysis. Organocatalysts, due to their various activation modes which could be combined in domino reactions, offer a way for a synthesis of complex molecules from a simple starting material.

This thesis deals with investigation of usage of chiral secondary amines as catalysts for asymmetric synthesis of cyclic compounds. The main part of research was devoted to development of organocatalytic method leading to synthesis of enantiomerically pure cyclopentanecarbaldehydes and nitrocyclopentanecarbaldehydes. We focused also on the organocatalytic preparation of cyclohexanecarbaldehydes.

During this work we developed an asymmetric domino Michael addition/α-substitution reaction of 2-(2-bromoethyl)malonates resp. 1-bromo-3-nitropropane with various enals catalyzed by chiral secondary amine. In the first case cyclopentanecarbaldehydes were formed where two chiral centres were created. In second case nitrocyclopentanecarbaldehydes were formed where three chiral centres were created. Yields of such developed reaction protocol reach up to 74 % and the reaction proceeds with excellent diastereo- and enantioselectivity (up to 19:1 *d.r.* and up to 99 % *ee*). Then we focused on an expansion of the developed reaction method for the preparation of cyclohexanecarbaldehydes and nitrocyclohexanecarbaldehydes. However, this exploration was not successful and we did not find suitable reaction conditions.

Further, we turned our attention to the usage of organocatalytic concept for the asymmetric preparation of five-membered heterocyclic compounds. After unsatisfactory results of reactions of *N*-substituted 2-bromoethylamines with various enals catalyzed by secondary amine in basic conditions, we prepared *N*-substituted derivatives of propargylamines. These substrates were used in reaction with enals catalyzed by combination of a secondary amine organocatalyst and a metal catalyst. The best results were obtained with *N*-*p*-toluensulfonyl propargylamine in a reaction with 2-methylacrolein catalyzed by Hayashi catalyst and copper (II) triflate in the presence of triphenyl phoshine, DMAP and sodium acetate. The cyclic product was obtained in 61 % yield with 92 % *ee*.