Abstract

This work is focused on the development of new enantioselective methods using synergistic catalysis. As part of this work, we devoted to the preparation of chiral heterocyclic spirocompounds using catalysis by combining chiral aminocatalyst and achiral transition metal complex.

The first part of the work deals with enantioselective reactions of imidazolones-derived vinylcyclopropane motif with *α*,*β*-unsaturated aldehydes in the presence of chiral secondary amine as organocatalyst and $Pd_2(dba)_3$ as transition metal catalyst, which are also commercially available. A series of spirocompounds bearing the imidazolone heterocycle were prepared in combined yields of 58-87% with diastereoselectivity up to 7:1 *dr* and with enantiomeric excess in range of 76-99% *ee*. In most cases, pure diastereoisomers were isolated, which can be further derivatized by subsequent transformations. Furthermore, new chiral secondary amines derived from pyrrolidine were prepared in this part. Prepared aminocatalysts were tested in a reaction leading to spiroimidazolones. The developed spirocyclization method was also used for the preparation of spiroazlactones, which were isolated in combined yields of 63-78% and with diastereoselectivity up to 5:1 dr, and with enantioselectivity of 83-98% *ee*. During the preparation of spiroazlactones, the effect of the enal used on the diastereoselectivity of the reaction was observed. In the case of the cyano group in the *para*-position of cinnamaldehyde, the corresponding spiroazlactone was obtained with the opposite ratio of diastereoisomers (1:2 *dr*) in a combined yield of 63% with enantioselectivity of 87/97% *ee*.

The final part of the work was devoted to the enantioselective reaction of thiazole derivatives containing a 2,5-dihydrooxepine motif with *α*,*β*-unsaturated aldehydes using synergistic catalysis. In the presence of commercially available chiral secondary amine and $Pd_2(dba)_3$, spirothiazolones were obtained in combined yields of 41-98% with diastereoselectivity up to 12:1 *dr* and enantiomeric excess from 86% to 99% *ee*. The prepared spirothiazolones can be transformed into 1,1,2,3,4-pentasubstituted cyclopentane without loss of enantiomeric purity.