Streszczenie w języku angielskim

In the last years, synthesis as well as use of optically active pyridine *N*-oxides as catalysts able to influence the stereochemical outcome of the reaction are in the area of researchers' interest. Oxygen atom in *N*-oxides on the one side can act as electron-pair donor, thus providing the appropraite electronic environment in the trnasition state formed during the reaction. On the other hand its nucleophilicity in combination with silicon's high affinity to oxygen creates perfect conditions for the development of synthetic methods based on nucleophilic activation of organosilicon compounds. However, the most effective and enantioselective *N*-oxide catalysts described so far are usually complex structures synthesised in a long, tedious and in consequence low-yield process. For that reason, relatively simple and readily available catalysts with equally high catalytic potenial are still highly desired.

Synthesis of compounds combining *N*-oxides and oxazoline moieties seemed to be very atractive due to unique properties representing by each group. This work presents the syntheis of a series of new, chiral oxazoline *N*-oxides based on several simple, often high-yield transformations. Designed and synthesised compounds posses in their structures fragment of pyridine, substituted pyridine, 2,2'-bipyridine or isoquinoline *N*-oxides and chiral oxazoline obtained from previously prepared aminoalcohols or those derived from natural amino acids. Replacement of the aminoalcohol with a chiral diamine or amine allowed us to expand the library of chiral *N*-oxide catalysts by imidazoline and imine compounds. In response to the properties and limitations imposed by target products, various synthetic pathways have beed designed and tested. Optimal conditions for the preparation of each group of compounds were selected. The work also discusses the encountered problems with the stability of *N*-oxide products.

The obtained compounds (68 structures) were examined as organocatalysts in the allylation of aldehydes (reaching up to 79% ee) or in the reduction of ketimin (reaching up to 27% ee). Selected compounds were also tested as ligands in the Cu(II)-catalyzed nitroaldol reaction (reaching up to 57% ee). Reasearch on the application of *N*-oxides in catalysis was not only limited to their use as catalysts but also includes their use as substrates. The (E)-2-(3-phenylacryloyl)pyridine *N*-oxide was examined in the asymmetric formal [3+3] annulation, involving Michael addition and intramolecular aldol condansation, leading to a chiral cyclohex-2-enone derivative with two stereogenic centers. Attempts to optimize the reaction conditions allow to achieve a completely regio- and diastereoselectivity (obtaining up to 65% ee).