Abstract

The topic of the dissertation includes stereoselective synthesis of 2-azabicycloalkane derivatives and application of the enantiomerically and diastereomerically pure compounds in multidirectional studies of both, biological and organocatalytic activity of the prepared compounds.

During conducted studies I modified the 2-azabicyclo[2.2.1]heptene scaffold, derived from efficient and stereoselective aza-Diels-Alder cycloaddition, from inexpensive and easily available substrates. I synthesized the series of novel, never published in the literature before, appropriately functionalized derivatives, *e.g.* sulfonamides, thioureas, amides.

The compounds designed for bioactivity studies were prepared to be tested as antiviral, antiproliferative and antimicrobial agents. Organocatalytic activity was studied in selected asymmetric transformations: aldol reaction, Michael addition and α-amination of carbonyl compounds.

The performed experiments proved the activity of several compounds which might be considered as novel drug candidates, *e.g.* 2-azabicyclo[3.2.1]octane derivative with dansyl substituent – inhibitor of protease VP24 of herpes virus type 1 – or fluorinated derivative with 2-azabicyclo[2.2.1]heptane skeleton with biphenyl substituent to use in cancer chemotherapy. Most of the synthetized 2-azabicycloalkane derivatives are not toxic toward normal cells.

Application of optically active dansyl sulfonamides with various *N*-heterocyclic units as organocatalysts in the reaction of electrophilic α-amination of 2-phenylpropanal yielded very promising results. Two organocatalysts (2-azabicyclo[2.2.1]heptane with secondary amine in the ring and pyrrolidine one) catalyzed the reaction very efficiently and highly enantioselectively (up to 100% yield and 98% *ee*, though the results obtained for a monocyclic derivative were more satisfying than those for a bicyclic one).

Synthesized and fully characterized derivatives and their undoubtable potential revealed in the studies described in the thesis constitute essential contribution into the chemistry of the chiral bridged *N*-heterocyclic compounds and might be considered as interesting subject to further exploration.