Abstract

The thesis is devoted to the stereoselective synthesis of 2-azanorborane derivatives. The bicyclic system was obtained in the asymmetric *aza*-Diels-Alder cycloaddition. The DA-products were in turn modified giving a set of 2-azabicyclo[2.2.1]heptanes and 2-azabicyclo[3.2.1]octanes, and a series of triazole and thiourea derivatives were prepared. During the preparation of the compounds diverse aspects were considered, including substitution, various linkers and functional groups towards multifunctional complex compounds and multivalency in the approach towards calix[4]arene based thiourea organocatalysts. Application of chosen triazoles yielded one characterized palladium(II) complex alongside a valuable insight in the formation of possible square-planar complexes with triazole functionalized 2-azabicycloalkanes. The thiourea derivatives were designed analogously to previously successful bifunctional organocatalysts with chiral moieties based on proline or *Cinchona* alkaloids. The substitution of the chiral backbone by the intrinsically chiral 2-azabicycloalkane yielded numerous novel thiourea organocatalysts. The obtained catalysts were used in model Michael-addition reactions. The addition of dimethyl malonate to β-nitrostyrene was catalyzed with up to 67% *ee*, whilst the addition of cyclohexanone to the latter nitro-vinyl compound yielded enantiomeric excesses of up to 96%. All triazoles and a selection of the derived thioureas were tested for their biological activity in broad scope of biological tests including satisfying initial results. The triazoles were tested as antiproliferative agents against various malicious cancer cell lines, accompanied by a structure-activity study. Chosen triazoles and thioureas exhibited also a promising behavior as antiviral and antifungal agents.