Description for the general public

The synthesis of substances in optically pure form enjoys continuous attention of many research centers working in the field of modern synthetic organic chemistry. A fact, that any compound occurs as single stereoisomer is particularly important when it will find a potential application in such industrial sectors like pharmaceutical, cosmetic or food industry. As commonly known, two stereoisomers (enantiomer or diastereoisomers) of the compound may vary significantly, for example – the smell (limonene, carvone), taste (aspartame) or, primarily, biological activity (such as the notorious thalidomide).

The main factor influencing both chemical yield and optical purity of the obtained chiral product, is a choice of the appropriate catalysts for given asymmetric reaction. Despite the fact, that until now there have been found and tested an enormous number of compounds fulfilling this function, the number of papers describing this type of studies increases exponentially. It should be noted, that both compounds with small molecules and simple structure (eg. some of the aminoacids) and such complex structures like enzymes or ribozymes are investigated.

The aim of the proposed project i san enter of the planned studies to the general trend of searching of new, highly efficient catalysts which are useful in asymmetric synthesis. We plan to synthesize systems, in which the leitmotivs will be a three-membered aziridine ring (thus, the simplest cyclic amine) and phosphine group. We made this choice knowing that aziridines perfectly coordinate metals, which frequently constitutes a key step of an effective course of asymmetric reaction and, on the basis of a fact, that aziridine phosphines are only scarcely reported in chemical literature. All the newly obtained compounds we are planning to test in asymmetric reactions, which are not explored by investigators like for example additions in the presence of organozinc species. It should be also mentioned, that in most cases such type of catalysts will be used for given stereocontrolled reactions for the first time.

Hence, the basic studies realized under proposed project will be consisted in the synthesis of new, optically pure aziridine derivatives (with the main focus on aziridine phosphines) and in the carrying out of testing asymmetric reactions for these new junctions. Such stereocontrolled processes in our opinion should lead to the products having a potential application in some areas like eg. pharmaceutics, in high chemical yields and with satisfactory grade of optical purity. As examples of asymmetric reactions which will serve us for checking a catalytic activity of newly obtained aziridine phosphine junctions can be mentioned: Negishi, Kumada and Sonogashira cross-coupling processes, Friedel-Crafts reaction, reactions with the participation of palladium (Heck and Trost-Tsuji reactions) or interesting Rauhut-Currier reaction. It should be also noted, that in testing asymmetric reactions a Chirality will be transferred from the molecules of chiral aziridine catalysts into molecules of the desired products of these reactions.