Among different biotechnologically important organisms fungi occupy the special place because of their wide range of applicability. They are used in industry as antibiotics, siderofors, organic acids, natural amino acids, enzymes producers also as factors of biological control of insects populations. Except of these positive meanings, fungi are also known as mycotoxins producers and as the risk factors in the feed and food production and storage. These features implies from their diversity and unique adaptive abilities. Fungal enzymatic systems are rich in constitutive and inducible proteins and active towards a number of non-physiological compounds - xenobiotic. Their metabolic pathways respond to the environment status by the activation or inactivation of particular enzymes, which are involved in primary or secondary metabolism. This is particularly important for their application as biocatalysts, because the selection of the culturing conditions influences the activity of enzymes of desired specificity. Fungal enzymatic systems are applied as a source of dehydrogenases (redox reactions), lipases (hydrolysis, esterification's), hydrolases and others for the xenobiotics conversions. Among others, following genera are known as biocatalysts: *Penicillium* sp., *Cladosporium* sp., *Rhizopus* sp., *Rhodotorula* sp., *Fusarium* sp., *Cuninghamella* sp., *Beauveria* sp., *Aspergillus* sp., *Saccharomyces* sp. They are capable to convert xenobiotics into desired products. Generally, biotransformations are chemical compounds conversions performed with the use of biological systems – whole cells or purified enzymes. These processes are selective and undergo under mild conditions but have limitations such as moderate effectiveness or water environment requirement. However, they are useful especially for the synthesis of the chiral molecules in optically pure forms and of defined absolute configuration. Such compounds are extremely important because among them, are biologically active structures of unique activities, essential for drug, antibacterials, antivirals, herbicides, pesticides, insecticides designing and synthesis. Chiral phosphonates of define absolute configuration are an example of mentioned, important class of compounds. Thus, amino and keto phosphonates derivatives are structural analogues of natural amino and keto acids so, they are applied as inhibitors of the enzymes involved in natural compounds conversions. Usually, drugs based on the phosphonates activity work in this way. Examples of the phosphonic enzymes inhibitors: 1-aminoethanephosphonic acid (alanine racemase and after in vivo conversion – pyruvate dehydrogenase), phosphonic analogues of Val, Leu, Met, Phe (aminoacyl-tRNA synthetase), carbobenzyloxy-derivative of phosphonic analogue of Val (human neutrophil elastase) or phosphonic analogues of phenyl glycine (phenylalanine ammonia-lyase). Thus the preparation of the optically pure phosphonates is constantly important and bioconversions are good alternative to chemical synthesis. Elaboration of the biocatalytic protocol for phosphonates formation is not a trivial challenge because of the substrates nature (e.g. enzymes inhibitors). Considering this, the application of the whole cells biocatalysts is preferable over the use of the purified enzymes. The diversity of the enzymatic systems allowed predicting that some of them will be active towards the phosphonic xenobiotics. Previous experiments clearly show that the most effective biological systems, in such context, are fungal ones. So, selected fungal strains will be tested towards following, chemically synthesised, phosphonates: racemic mixtures of heterocyclic amino phosphonates and prochiral fluoro-keto phosphonates. Earlier experiments proved, that kinetic bioresolution of the racemic mixtures of amino phosphonates is possible and performed *via* oxidative deamination with ketone formation, which is then reduced to the hydroxyl derivative by single fungal strain. This allowed assuming that also racemic mixtures of the heterocyclic amino phosphonates will be resolved by bioconversion. Also, prochiral keto phosphonates were objectives of the previous experiments, what resulted in the optically pure, hydroxyphosphonates synthesis. Thus, this is the starting point for the fluoro-ketones reduction. Effective bioconversions on laboratory scale allow selecting the processes for scaling up. Such undertake will be performed with free and immobilized mycelium and generally in two ways: with the use of batch and continuous models of reactors. Finally the elaboration of the bioconversion protocols on the preparative scale will have significant meaning not only for science development but also for environment protection by introducing the green solution into drug synthesis.