Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, Supplement, S28
http://omicron.ch.tuiasi.ro/EEMJ/

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AMINOPHOSPHONATE XENOBIOTICS AS NUTRITIVE PHOSPHORUS SOURCE FOR MYCELIAL FUNGI CAPABLE FOR C-P BOND BIODEGRADATION

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Abstract

Due to their permanence/persistance and simultaneously a broad and increasing range of applications, aminophosphonic xenobiotics belong to the onerous compounds for numerous inhabitants of various environments. Scientific efforts dedicated to fate and biodegradation of aminophosphonic compounds in environment had begun in 80's last century. Currently it is known that many microorganisms, mainly bacteria, are able to decompose the C-P bond. Interestingly, similar ability of filamentous fungi, which are known from their skills to adaptation to various nutritional conditions was studied hardly less intensive so far.

Considering the increasing usage of aminophosphonates, our still fragmentary knowledge about the environmental fate of such substances, especially about their interaction with mycelial fungi, the study on ability of representatives of mentioned microorganisms for degradation of aminophosphonic compounds, were conducted.

Nine strains of fungi: *Alternaria alternata, Aspergillus niger, Aspergillus terreus, Fusarium dimerum, Fusarium oxysporum, Penicillium janthinellum, Penicillium simplicissimum, Paecilomyces variotti* and *Trichoderma koningii* and seven phosphonic compounds were chosen. Two main aspects of abiotic interactions, namely fungal sensitivity towards phosphonates used in the range of concentrations from 1 to 10mM and the ability of fungi to transform these compounds, were studied. The experiments related to sensitivity of fungi towards phosphonates were conducted in classic Czapek media, which contained inorganic phosphate and phopshonates as additives, whereas the ability of these biota to degrade aminophosphonates was studied in two kinds of Czapek medium: the one, supplemented with phosphonates and the second containing phosphonates as the sole phosphorus sources. Toxicity of phosphonates were set by measurements of dry mass of mycelium as well as macro and microscopic examinations of the fungi, while biotransformation was investigated employing various technics of nuclear magnetic resonance spectroscopy, mainly 31P NMR. Other analytical methods such HPLC –UV and GC-MS were also applicated in few cases when some more detailed experiments regarding the metabolization of phosphonates were carried out.

The results of presented study, show that tested fungal strains were substantially resistant towards action of examined aminophosphonate compounds, with some of the fungi being able not only to transform and/or degrade studied compounds, but also to utilise them as a nutritive phosphorus source for growth. Moreover, the process of biodegradation seemed to proceed independently on phosphorus status of fungal cells, being often accompanied by release of intermediate metabolites containing also C-P bonds.