

MSc. Tatiana Stella: Bioremediation of persistent aromatic pollutants

Dissertation thesis

The environmental impact of organic pollutants, mostly of anthropogenic origin, is of increasing interest due to their persistency and often of serious effects on the environmental health. Many of these compounds represent industrial chemicals that were deliberately released into the environment. Others belong to undesired chemical by-products, personal care compounds or pharmaceuticals that resist against microbial or chemical processes, either during waste water treatment or in soil.

Bioremediation is often characterized as cost-effective and environmental friendly approach for the removal of contaminants from the environment. As cleanup tools, various types of organisms are employed, mainly microorganisms or plants. The bioremediation methods have been established to exploit mostly bacterial microorganisms and their limits have been repeatedly reviewed. There are several limiting factors that can significantly restrict successful bacterial application for biodegradation of especially aromatic pollutants present in the environment. The bacterial biodegradation of organopollutants is mainly performed by intracellular enzymes with high substrate specificity. This results in limited availability of compounds with low water solubility. In bacterial degradation, these compounds are used as sources of carbon and energy. However, the process is active only above a certain concentration threshold. Moreover, genes responsible for organopollutant transformations are very often localized on plasmids. If the bacteria are not exposed to presence of the compounds for a longer time, the activity of the genes easily disappears. However, these impediments can be overcome by the application of fungi for degradation.

Due to the facts mentioned above the subject of the thesis is very topical.

The thesis consists of chapters that are commented below. The general introduction well describes classical physico-chemical remediation methods in comparison with bioremediation techniques with a special emphasis on fungal technologies. The next chapter includes a development and optimization of a mycoremediation technique designed for removal of polychlorinated biphenyl from soil with a deep study of various aspects influencing the process. The study implements various interdisciplinary approaches representing methods of analytical chemistry, ecotoxicology, molecular biology and environmental microbiology. The following chapter deals with enzymatic degradation mechanisms of polychlorinated biphenyls

and their metabolites. The concluding remarks summarize on the well-established background the results achieved in this thesis that have been already published by the candidate.

The thesis is overall clearly written in English on a good level and the outcomes are innovative. The candidate is the author and coauthor of 2 publications in journals with impact factors. She presented her results as lectures and posters at several international conferences. Tatiana has clearly demonstrated her ability for scientific work.

In this context and due to the facts mentioned above I recommend the thesis of MSc. Tatiana Stella to be defended.

Topics for discussion:

You had to get familiar with many methods, analytical, toxicological and molecular biological, for characterization of the bioremediation processes. Can you comment their reliability?

How do you see the possibility of application of bioremediation, namely the use of the white rot fungi, for improving the environment, in reality?

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