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MYCOREMEDIATION OF CONTAMINATED SOIL IN FIELD SCALE

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Abstract

Ligninolytic fungi are known to be able to degrade organic contaminants with their non-specific enzymes. Thus, attempts have been made to find the best fungi to grow in soil, tolerate toxic xenobiotics, in addition to degrade the contaminants. The most promising fungi belong to litter-decomposing fungi which grow in soil, and in several screenings many promising candidates have aroused. One of the most promising fungal strains found in the Fungal Biotechnology Culture Collection (FBCC) of University of Helsinki is *Phanerochaete velutina*, FBCC941. This fungus grows into soil when introduced with pine bark, and produced manganese peroxidase (MnP) in solid state cultivations.

We performed several field scale (up to 13 t soil) or pilot scale experiments with fungal treatment, in which the inoculation technique and the support material were optimized. The compounds in focus were trinitrotoluene (TNT), polyaromatic hydrocarbons (PAH) and polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/F). Remediation was monitored in order to clarify the activity of the fungus and the role of the native microbial population together with chemical analysis of the soil. Quantitative PCR was used for determination the survival of the fungus in soil together with PAH-degrading bacterial genes in PAH contaminated soil. Decrease in toxicity of the soil was measured with earthworms, cress and clover.

In some of the experiments extremely high concentration of PAH (5000 mg/kg) and TNT (>10 g/kg TNT) inhibited the fungal growth, and thus no degradation of the contaminants occurred. Dilution of PAH and TNT contaminated soil with garden compost (ratio 1:1 and 1:20, respectively) reduced the toxicity and enabled the fungal growth to soil, but enhanced also the growth of indigenous microorganisms present either in soil or compost. The good quality of the fungal inocula was found to be essential for the growth in contaminated soil. Severe contamination with molds, such as *Trichoderma* prevented growth of *P. velutina* completely, but if contamination was minor, *P. velutina* was able to outcompete the molds. However, in optimal conditions 93 % of PAHs were degraded by both fungus *P. velutina* and indigenous bacterial population. *P. velutina* was also the most efficient degrader of TNT. Degradation of PCDD/F could not be proved due to tremendous variation of concentrations in all soil samples (in average concentration was approximately 10 000 ng/kg WHO-TEQ).

More experiments are needed to determine the minimum inoculum-soil ratio and other constraints for the fungal treatment method.