Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, Supplement, S45
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

P12

ECO-EFFICIENCY ANALYSIS OF A FUNGAL BIOREMEDIATION METHOD

Markus Räsänen*[1], Erika Winquist[1], Marja Tuomela[2], Matti Leisola[1], Jaana Sorvari[3]

[1]Department of Biotechnology and Chemical Technology, P.O. Box 16100, 00076 Aalto University, Finland; [2]Department of Food and Environmental Sciences, P.O. Box 56, 00014 University of Helsinki, Finland; [3]Finnish Environment Institute (SYKE), P.O. Box 140, 00251 Helsinki, Finland; e-mail: markus.rasanen@aalto.fi

Abstract

A novel fungal bioremediation method was compared to more conventional soil clean-up technologies using an eco-efficiency analysis tool developed in the Finnish Environment Institute. The study focused on a treatment of PAH-contaminated soil using six alternative soil remediation methods: hazardous waste landfilling, thermal treatment, bitumen stabilization, aerated fungal treatment, fungal treatment without aeration and aerated garden waste compost treatment. For the eco-efficiency analysis, data was compiled on the costs, environmental effects and achievable risk reduction of these alternative remediation techniques.

The fungal treatment method was a main focus and data for its eco-efficiency appraisal was generated in a separate field study using 2 tons of PAH-contaminated soil. The soil was first diluted 1:1 (mass ratio) with garden waste compost, which resulted in the concentration of approximately 1400 mg PAH/kg soil (sum of 16 EPA PAH). During a 5-month-treatment the PAHs degraded similarly in both the fungal treatment pile (inoculated with white-rot fungus *Phanerochaete velutina* FBCC941, obtained from the Fungal Biotechnology Culture Collection of University of Helsinki) and the control pile (without fungal inoculum). The concentrations of the PAHs after 5 months were approximately 100 mg/kg (fungal treatment) and 80 mg/kg (control). The degradation of the PAHs took virtually place in both soil piles during the first 3 months of the experiment.

In the eco-efficiency analysis, thermal treatment turned out as the most eco-efficient method, which lowered the risks effectively and economically, without significant environmental effects. The second most eco-efficient method was bitumen stabilization, but it is quite questionable method regarding sustainability because stabilization doesn't remove the pollutants from the soil, and it always requires a disposal. Aerated garden waste compost treatment and fungal treatment without aeration with low inoculation ratio did also well in the eco-efficiency comparison. It can be concluded that fungal treatment could have potential in remediation of PAH-contaminated soils, as well as other contaminated soils, when properly optimized. Without aeration and with optimized compost to soil ratio garden waste compost treatment could offer a highly eco-efficient method for remediation of PAH-contaminated soil.