

Digestate valorisation for soil remediation: landfarming of hydrocarbons contaminated soils

PhD Student: Anna GIELNIK (1st year)

Promoter: Eric VAN HULLEBUSCH Co- Promoters: David HUGUENOT, Giovanni ESPOSITO, Gilles GUIBAUD



General context

Petroleum industry generates contaminants which may affect well-prospering of soil ecosystems and constitute a threat to soil biota and human health. Total Petroleum Hydrocarbons (TPHs) is a term used to describe a family of several hundred chemical compounds that originally come from crude oil. Within remediation practices, bioremediation is the most public acceptable, the cheapest and the less invasive method which has a great potential for further improvement and development. The use of digestate in bioremediation is an innovative approach, which represent a promising idea to reconcile the biogas production with the environmental-friendly and economical way of waste management and soil clean-up (1).

Objectives and stakes

The objective of this study is to develop the best practices for successful remediation of hydrocarbons contaminated soils by utilizing digestate as organic amendment for enhanced Total Petroleum Hydrocarbons (TPH) bioremediation. The aim will be achieved by selecting the most optimal operating conditions for TPH degradation obtained during laboratory-scale composting in bioreactors.

Methodology/ Experimental approach

This study includes analysis of digestate organic fractions (lignin, hemicellulose, cellulose, complex lipids, steroids) as well as analysis of its biological stability manifested by DRI (Dynamic Respiration Index). Selection of optimal condition for bioremediation treatment (digestate type, soil/organic amendment mixing ratio, water content, C:N:P ratio) will be performed at laboratory scale during microcosm experiment. Selected conditions will be applied in bioreactor experiment. During this experiment, the monitoring of microbial activity and diversity as well as chemical and physical parameters will be performed. Additionally, ecotoxicological assessments will be performed (Microtox analysis on *Vibrio fischeri* and germination tests on *Lepidium sativum*). The conditions selected during bioreactor experiment will be applied in a greenhouse experiment. The aim of this experiment is to investigate the impact of digestate application together with Ryegrass (*Lolium remotum*) cultivation and biosurfactant application on the bioavailability of TPH in soil.

Main results

- Chemical characteristics of digestate and assessment of its potential applications as a surfactant
- Microbiological assessment of digestate impact on soil microflora
- Improved knowledge on conditions optimal for soil bioremediation

References

(1) Namkoong, Wan, Eui Young Hwang, Joon Seok Park, and Jung Young Choi. 2002. 'Bioremediation of Diesel-Contaminated Soil with Composting.' *Environmental Pollution* 119 (1): 23–31.

