SERDP
Strategic Environmental Research and Development Program

Cleanup
CU-1095

Assessment and Prediction of Biostabilization of Polycyclic Aromatic Hydrocarbons in Sediments

Background:

There exists a great need to understand contaminant-sediment interactions and their effect on the bioavailability and toxicity of sediments, especially for hydrophobic organic compounds like polycyclic aromatic hydrocarbons (PAH). The adherence and slow release of PAHs from soils or sediments, i.e., geosorbents, is an obstacle to remediation and is challenging our concepts about cleanup standards and risks. This is particularly the case for the biological treatment of PAHs where one of the most important of the site-specific factors is the availability of the compounds held within solids and how this affects treatment rates and acceptable toxicological endpoints. Biostabilization is a newly-developed concept whereby accessible pollutant fractions are biodegraded in a soil or sediment matrix, leaving a bound residue that is much more biologically unavailable and immobile.

Objective:

The objectives of this research are to identify those factors affecting biostabililization of PAHs on sediments and to develop the technical basis for enhancing natural recovery processes involved in the in-situ biotreatment of sediments contaminated with PAHs.

Summary of Process/Technology:

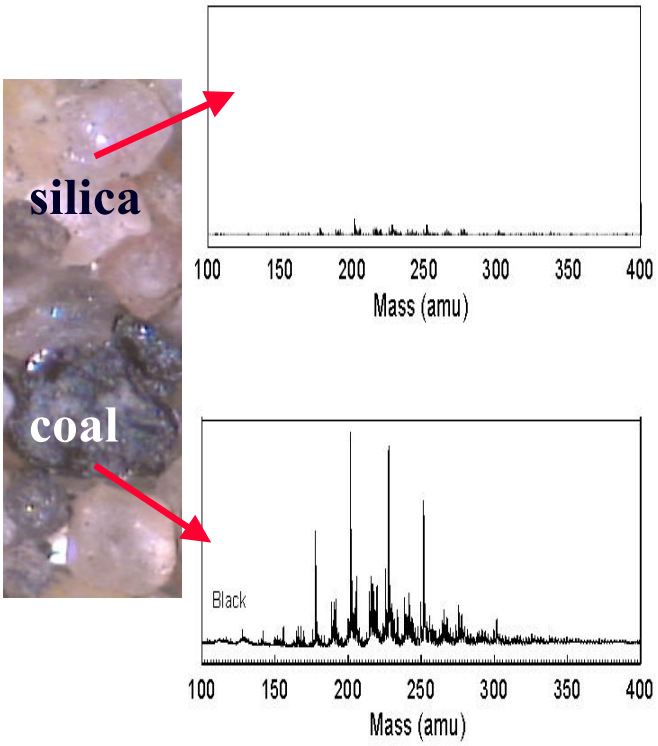
This research will use unique, complementary spectroscopic techniques to assess where and how PAHs are bound to sediments. It also will assess the grain-scale distribution of PAHs at a resolution of about 40um diameter spot or less on geosorbents. These observations, in combination with spectroscopic investigations of carbon location and type, plus thermal spectroscopy analyses, will provide data on the heterogeneous distribution of PAHs on geosorbents. These data then can be used to provide more direct proof of the types of associations PAHs have with geosorbents and thus help develop more appropriate conceptual models of sequestration processes.

Benefit:

The potential benefits of this research include the following: reduced treatment costs, improved evaluation and design for cleanup technologies, greater regulatory and public acceptance of biostablization, increased reuse/recovery opportunities for treated contaminated dredged materials, and the potential application for in-capped sediments.

Accomplishments:

The research team has performed PAH analysis on size and density separated samples of Milwaukee Confined Disposal Facilities (CDF) sediment. The CDF sediment was used to evaluate the relative abundance of PAHs in the various bulk components found within the sediment. Analysis of the sediment found that coal and wood derived particles contained most of the PAHs in the sediment. Researchers found that clays release PAHs much faster than coal and wood derived particles, thus providing evidence that suggests that coal and wood are major PAH sorbers. Currently, solid phase desorption experiments are being conducted to study PAH desorption kinetics using size and density separated Milwaukee CDF sediment components.



PAH Mass Signal

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