Progress on Treatment of PCB-Impacted Sediments with Bioamended Activated Carbon

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Background/Objectives. In situ treatment with granular activated carbon (GAC) has been used successfully to sequester aromatic POPs such as PCBs in sediments effectively minimizing their interaction with the aquatic food chain. We describe results from in situ studies on PCB impacted sediments sites treated with bioamended form of GAC embedded with microorganisms to concurrently sequester PCBs from the food chain and dechlorinate and degrade PCBs in sediments. Pilot- and full-scale treatment sites include a wetlands drainage creek, sewage treatment pond, stormwater basin and soil landfill. Results include an assessment of the optimal loading cell titer and carbon loading rates, the scalability of growing PCB respiring microorganisms for field application and the effect of bioamended AC treatment on concentrations of PCBs in sediments and porewater.

Approach/Activities. The innovative aspect of the technology is the application of anaerobic organohalide respiring bacteria and aerobic PCB degrading bacteria with selected activities to sediments with a GAC agglomerate (SediMite™) as a delivery system. The bioamended SediMite serves as a solid substrate for: 1) delivery of microorganisms into sediments, 2) formation of microbial biofilms, and 3) sequestration and concentration of hydrophobic PCBs in close proximity to the biofilm of PCB transforming bacteria. Treatments were conducted by passive mixing in open water plots and active mixing in field caissons. The effectiveness of the approach was evaluated by monitoring changes in total PCB concentration and congener distribution, porewater concentrations with passive samplers and effect of treatment on the indigenous microbial community.

Results/Lessons Learned. Technical challenges for the pilot field study included production-level scale-up of the microorganisms without residual POPs, production of SediMite modified as a carrier for the bioamendments, development of an inoculation system to introduce active PCB-transforming microorganisms into SediMite pellets during deployment at the site, and maintaining viability of the anaerobes and aerobes during the deployment process. Total PCB levels were reduced by up to 80% in bioamended treatments, whereas untreated controls showed no significant change. Methodology, challenges associated with deployment and post-treatment results for total and aqueous concentrations of PCBs, sustainability of the bioamendment and effect on indigenous microbial populations will be discussed. In situ treatment by bioaugmentation has the potential to significantly reduce the environmental impact compared with dredging by reducing the health risks associated with sediment disruption, reducing overall energy use, effectively negating the requirement for extensive waste management and substantial habitat restoration.