APPLICATION AND ASSESSMENT OF AMENDMENTS AT SEDIMENT SITES

RICHARD G. LUTHY
Stanford University
Department of Civil and Environmental Engineering
Stanford, CA 94305-4020
(650) 723-3921
luthy@stanford.edu

CO-PERFORMERS: Y.M. Cho (Stanford University); U. Ghosh (University of Maryland Baltimore County); A. J. Kennedy, T. S. Bridges (ERDC)

A field test at an inter-tidal mudflat examined the bioavailability and uptake of polychlorinated biphenyls (PCB) in biota exposed to sediment amended with activated carbon (AC). In-situ and ex-situ bioassays suggest that PCB bioaccumulation in marine clams is reduced when exposed to sediment treated with 2% to 3% AC in comparison to unmixed and mixed control plots. This paper will discuss differences among laboratory and field tests, the confounding field-related factors on in-situ bioassay results, and the need for predictive models to assess long-term trends in PCB pore water concentrations. Limited contact between AC and sediment in the field slows mass transfer and the stabilization of PCBs. Still, the sequestration potential of AC was evident during the entire project period. Using a one-time, approximately 30-minute mixing event, AC amendment was able to reduce available PCB portions in pore water by more than 50% for a continuous passive sampler exposure lasting seven months. Furthermore, with additional mixing in the laboratory, AC-amended field sediment showed more than 95% reduced partitioning into the aqueous phase depending on AC dose, which confirms that the potency of AC was retained. Importantly, the study revealed a number of field-related factors (e.g., sediment deposition and seasonal effects) that can confound the results of in-situ bioassays, and points to the necessity of conducting complementary physicochemical tests, and ex-situ bioassays, so that the benefit of the in-situ treatment can be inferred independent of other factors. A set of tests confirmed that fresh sediment deposition occurring over 18 months after AC treatment confounded results of in-situ bioassays via surface deposit-feeding clams, altering exposure and PCB accumulation and masking the underlying sediment. Further, we demonstrate the effects of AC dose and mixing regime on reduction in PCB bioaccumulation by comparing data collected for sediment-AC contact under well mixed, homogeneous conditions in the laboratory versus sediment-AC contact under a one-time, brief mixing event in the field. The lower reductions in PCB bioaccumulation observed in the field calls for predictive models to assess long-term trends in PCB-pore water concentrations and the benefits of alternative AC application and mixing strategies. Overall, this study indicates that if ongoing PCB contaminant sources are eliminated and freshly deposited sediments are clean, in-situ AC amendment of contaminated sediments can provide a suitable method for reducing exposure to the water column and biota where the source of the contaminant is from the sediment.