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A passive sampler based on solid phase microextraction (SPME) for quantifying hydrophobic organic contaminants in sediment porewater

Keith A. Maruya, Eddy Y. Zeng[1], David Tsukada and Steven M. Bay

[1]Chinese Academy of Sciences, Guangzhou Institute of Geochemistry, State Key Laboratory of Organic Geochemistry, Guangzhou, China

ABSTRACT

Sediment quality assessment is often hindered by the lack of agreement between chemical and biological lines of evidence. One limitation is that the bulk sediment toxicant concentration, the most widely used chemical parameter, does not always represent the bioavailable concentration, particularly for hydrophobic organic compounds (HOCs) in highly contaminated sediments. In this study, a porewater sampler that utilizes solid phase microextraction (SPME) to measure freely dissolved ("bioavailable") HOC concentrations was developed and tested. A single polydimethylsiloxane (PDMS) coated SPME fiber was secured in a compact protective housing that allows aqueous exchange with whole sediment while eliminating direct contact with sediment particles. Fibers with three PDMS coating thicknesses were first calibrated for 12 model polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), DDTs, and chlordanes, representing HOCs of current regulatory concern. Pre-calibrated samplers were exposed to spiked estuarine sediment in lab microcosms to determine the time to equilibrium and equilibrium concentrations across a range of sediment contamination. Time to equilibrium ranged from 14 to 110 days, with 30 days being sufficient for more than half of the target HOCs. Ranging from 0.009 to 2400 ng/L, equilibrium SPME measurements were highly correlated with, but generally lower than HOC porewater concentrations determined independently by liquid-liquid extraction. This concept shows promise for directly measuring the freely dissolved concentration of HOCs in sediment porewater, a previously difficult-to-measure parameter that will improve frameworks for assessing the impacts of contaminated sediments.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2008AnnualReport/AR08_039_049.pdf