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Comparing solid phase microextraction and polyethylene passive samplers for measuring ultra-low aqueous concentrations of regulated organic pollutants

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ABSTRACT

Solid phase microextraction (SPME) fibers and low-density polyethylene (PE) passive samplers were co-exposed in spiked water experiments and in an impacted urban waterway to compare their performance in detecting ultra-trace levels of waterborne organic pollutants. Detections of nine model hydrophobic organic compounds (HOCs) using PE was greater than for SPME for spiked aqueous concentrations (C_w) less than 0.1 ng/L. The greater sensitivity of PE was confirmed *in situ*, with detectable levels as low as 1 pg/L for selected polychlorinated biphenyl (PCB) congeners. In laboratory studies, concentrations of targeted polycyclic aromatic hydrocarbons (PAHs), PCBs and chlorinated pesticides detected by SPME were within a factor of 2 on average to those measured using liquid-liquid extraction (LLE), while PE measurements were within a factor of 4 of LLE and were biased low, possibly due to uncertainties in PE equilibrium-partitioning coefficients. When *in situ* PE-measured concentrations were corrected for disequilibrium using performance reference compounds, the average ratio of SPME to PE for *in situ* concentrations was 1.8, indicating good overall agreement between the two passive samplers. *In situ* C_w values for SPME and PE were 70% (n = 4) and 210% (n = 6) on average of operationally dissolved C_w values determined on XAD resin with values for individual chemicals ranging from 20 to 140% (SPME/XAD) and from 27 to 590% (PE/XAD). Although uncertainties (e.g., error associated with laboratory-measured equilibrium constants and corrections for disequilibrium) surrounding calibration parameters and equilibrium have not been fully resolved, these results indicate that both SPME and PE show promise as ambient sampling tools for contaminants of regulatory concern in the aquatic environment.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2010AnnualReport/ar10_045_056.pdf