

Measuring freely dissolved DDT and metabolites in seawater using solid-phase microextraction with performance reference compounds

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ABSTRACT

The coupling of disposable solid-phase microextraction (SPME) with performance reference compounds (PRCs) has been recently introduced to measure time-averaged freely dissolved concentrations (C_{free}) of hydrophobic organic contaminants in sediments under laboratory conditions. To explore the use of PRC-SPME for in situ sampling in seawater, disposable PDMS fibers (35- μm and 100- μm coating) preloaded with stable isotope labeled analogues as PRCs were deployed at six stations (each with three depths) in the open ocean of the Palos Verdes Shelf (CA, USA) Superfund site for 33 d to measure C_{free} of DDT and its degradates. The observed values of fractional equilibration (f_{eq}) of PRCs were mostly ≤ 0.85 , suggesting nonequilibrium conditions at the end of deployment. The observed f_{eq} s for the samplers varied with compound, sampling station and depth, validating the need for calibration to derive accurate C_{free} . The C_{free} values of DDE and DDD determined with PRC-SPME were in good agreement with those previously measured by in situ large-volume water sampling or polyethylene devices. The highest C_{free} in seawater 5 m off the ocean floor was 750 pg L^{-1} for *o,p'*-DDE, 2170 pg L^{-1} for *p,p'*-DDE, 24 pg L^{-1} for *o,p'*-DDD, and 75 pg L^{-1} for *p,p'*-DDD. Results of this study demonstrated the feasibility and advantages of using disposable PDMS fiber coupled with PRCs for in situ sampling.

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