In situ biodegradation in contaminated sediments assessed by Compound Specific Isotope Analysis with high-resolution sampling

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Contaminated sediments have raised considerable concern due to potential risks to the environment and human health. Understanding the fate of contaminants in the environment and the potential for natural attenuation may help protect aquatic resources. In this study, Compound Specific Isotope Analysis (CSIA) of monochlorobenzene (MCB) and benzene was carried out on pore water samples collected across the sediment surface water interface (SWI) in a field site located in New Jersey, USA. Samples were collected at four locations using a passive diffusion sampler with a high-resolution (3 cm) vertical spacing over 60-90-cm of sediment column in accordance with the method described by [1].

Concentrations of MCB and benzene decreased markedly from the bottom to the top of the sediment column at all four locations. This decrease in concentration correlated with a strong and progressive enrichment in ^{13}C in the carbon isotope signatures for MCB. Overall enrichment of up to 5.7‰ was observed. Benzene showed the inverse trend – a significant depletion in ^{13}C in the carbon isotope signatures by up to 7‰. Such large and correlated trends of isotopic enrichments in ^{13}C for MCB and depletion in ^{13}C for benzene are consistent with isotope signatures expected for parent contaminants and resulting daughter products during *in situ* biodegradation. Most importantly, in the uppermost part of the sediment, the trend for benzene reversed; as benzene concentrations decreased to below detection limits, isotopic enrichment in ^{13}C for the remaining benzene was observed, indicating the remaining benzene is being biodegraded *in situ*.

[1] Passeport *et al*. (2014) *ES&T* **48**, 9582-9590.