Abstract

In recent years, Compound Specific Isotope Analysis (CSIA) has undergone a rapid development towards important new applications in contaminant hydrology and organic biogeochemistry. With CSIA, the relative abundance of the heavy and light isotopes of a given element (e.g. $^2\text{H}/^1\text{H}$, $^{13}\text{C}/^{12}\text{C}$, $^{15}\text{N}/^{14}\text{N}$, $^{18}\text{O}/^{16}\text{O}$, $^{37}\text{Cl}/^{35}\text{Cl}$) can be determined for a given compound. Such bulk isotope ratios (= ratios averaged over the bulk compound), particularly, when available for more than just one element (e.g., H and C, C and N) may be extremely useful for (i) identification of contaminant sources, (ii) qualitative assessment of transformation processes, (iii) assessment of reaction pathways and reaction mechanisms, and (iv) quantification of transformation processes, particularly in complex systems. For the assessment of reaction pathways and for quantification of transformation processes, enrichment factors have to be derived from series of isotope measurements at different times and/or locations. For the interpretation of such enrichment factors, it is necessary to convert them properly to apparent kinetic isotope effects. In the lecture, the possibilities and limitations of the application of isotope fractionation data to assess organic pollutant behavior in natural and engineered systems will be discussed using a variety of practical examples including chlorinated solvents, gasoline components (BTEX), MTBE, and nitroaromatic explosives.