Two Complementary Sides of Bioavailability: Accessibility and Chemical Activity of Organic Contaminants in Sediments and Soils

Research during the last decade has led to several competing concepts of bioavailability and to many more methods to measure bioavailability. One reason for disagreement is the confusion of two fundamentally different parameters, accessible quantity and chemical activity. The accessible quantity describes a mass of contaminants, which can become available to, for example, biodegradation and biouptake. It can be determined with mild extraction schemes or depletive sampling techniques. The chemical activity, on the other hand, quantifies the potential for spontaneous physicochemical processes, such as diffusion, sorption, and partitioning. For instance, the chemical activity of a sediment contaminant determines its equilibrium partitioning concentration in sediment-dwelling organisms, and differences in chemical activity determine the direction and extent of diffusion between environmental compartments. Chemical activity can be measured with equilibrium sampling devices and, theoretically, is closely linked to fugacity and freely dissolved concentration. The distinction between accessibility and chemical activity is outlined, and the benefits and limitation of both endpoints are provided. Finally, examples of how to measure and apply them are presented.

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