

Contents in Context

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The Key Role of Environmental Colloids/Nanoparticles for the Sustainability of Life

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The sustainability of ecosystems depends on environmental nanoparticles. This essay gives an overview of field of environmental nanoparticle research, including current knowledge and pertinent questions regarding the structure and function of environmental nanoparticles in soil and sediment microstructure, nutrient bioavailability, and the transport of both essential and toxic compounds.

Aquatic Colloids and Nanoparticles: Current Knowledge and Future Trends

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The fate and behaviour of trace pollutants are very strongly modified, and usually dominated, by their physical and chemical interactions with naturally occurring aquatic colloids (defined as solid phase material with one dimension between 1 nm and 1 μm). This review summarises the area and key advances in the field of natural aquatic colloids, including technique development and quantification of colloidal structure and interactions with pollutants. The review also discusses areas in which significant advances are likely to be made or are needed and, as such, provides a framework for further work in the next few years.

Protective Role of Alginic Acid Against Metal Uptake by American Oyster (*Crassostrea virginica*)

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Trace metals are both micronutrients and toxicants, depending on concentration, and in coastal waters they bind to natural organic matter including nanoparticles. The binding type affects trace metal bioavailability to bivalves such as oysters, which ingest metals through water and food particles. Bivalves are biomonitors because of the high trace metal concentrations, especially Cu and Zn, in their tissues. Here, the polysaccharide alginic acid is shown to protect against the assimilation and bioavailability of trace metals to American oysters.

The Influence of Sample Preparation on Observed Particle Size Distributions for Contrasting Soil Suspensions using Flow Field-Flow Fractionation

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Colloids are an important environmental means for contaminant transport from land to water. Within the agricultural landscape, the mobilization of phosphorus species by soil leachate and drainage waters is a particularly important example. Colloidal material is, however, difficult to isolate and characterize, due in part to the dynamic nature of environmental systems and colloidal structure and in part to the lack of suitable analytical techniques. Field-flow fractionation is one emerging tool for the investigation of colloidal fractions in environmental matrices and for assessing how soil processes impact on water quality.

Asymmetrical Flow Field Flow Fractionation–Multidetector System as a Tool for Studying Metal–Alginate Interactions

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Environ. Chem. 2006, 3, 192

Acidic polysaccharides are important components of the organic matter in ecosystems that are involved in the transport of metal pollutants. They are able to affect trace element cycling, both due to their metal binding properties and to their effect on aggregation and sedimentation of organic matter. In order to obtain more information regarding their role as metal pollutant carriers, the size distributions of alginate and metal alginate complexes have therefore been studied with novel instrumentation.

Colloidal Metals in the Tamar Estuary and their Influence on Metal Fractionation by Membrane Filtration

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Trace metals play an essential role in the growth and function of aquatic organisms; however, enhanced metal concentrations can have detrimental effects on ecosystems. The distribution of metals between filterable and filter-retained phases is key to their bioavailability and biogeochemical cycling. Studies on rivers have shown that separating dissolved metals from particle-associated metals may introduce significant artefacts in the resulting filtrate concentrations. Comparable studies on turbid estuarine waters are necessary to improve the design of water sampling programmes.

Bioaccessibility of Arsenic Bound to Corundum Using a Simulated Gastrointestinal System

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Environ. Chem. 2006, 3, 208

Ingestion of soil contaminated with arsenic is an important pathway for human exposure to arsenic. The risk posed by ingestion of arsenic-contaminated soil depends on how much arsenic is dissolved in the gastrointestinal tract. Aluminum oxides are common components in the soil and act as a sink for arsenic. Knowledge of the behavior of arsenic associated with aluminum oxide surfaces in a simulated gastrointestinal tract will provide an understanding of the ingestion risk of arsenic-contaminated soil to humans.

Novel Mild Hydrodechlorination of PCDDs, PCDFs, and co-PCBs inside Fly Ash Using a Calcium-Promoted Rhodium Carbon Catalyst in Methanol

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The generic term 'dioxins', the family of which includes polychlorinated dibenzo-*p*-dioxins, polychlorinated dibenzofurans, and dioxin-like compounds such as coplanar polychlorinated biphenyls (co-PCBs), is used to describe highly toxic and mutagenic compounds. Many methods that involve high-temperature or high-pressure dry hydrogen conditions to ensure adequate decomposition for persistent chlorinated aromatic pollutants present disadvantages for repeated synthesis or recovery of vaporized dioxins and co-PCBs. We discovered that highly efficient degradation of dioxins in fly ash is accomplished in 24 h using metallic calcium and Rh/C in alcohol in a sealed tube at 25°C at 0.15 MPa.

Comparative Analysis of Soluble Phosphate Amendments for the Remediation of Heavy Metal Contaminants: Effect on Sediment Hydraulic Conductivity

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The contamination of surface and subsurface geologic media by heavy metals and radionuclides is a significant problem within the United States Department of Energy complex as a result of past nuclear operations. Water-soluble phosphate compounds provide a means to inject phosphorus into subsurface contaminant plumes, to precipitate metal ions from solution. However, phosphate phases can form within the sedimentary pore structure to block a fraction of the pore space and inhibit further remediation of the contaminant plume. A series of tests have been conducted to evaluate changes in sedimentary pore structure during the application of several proposed phosphate remediation amendments.

Characteristics of the Acidity in Acid Sulfate Soil Drainage Waters, McLeods Creek, Northeastern NSW, Australia

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Acid sulfate soils are found in many low-lying coastal areas, but they can also be encountered in inland areas of Australia and other parts of the world. These soils typically contain iron sulfides, primarily pyrite (FeS₂) and mackinawite (FeS), and the products that result from oxidation of these iron minerals. Acidic and metal-rich waters can be produced when the pyrite in soil is oxidized by natural means or accelerated when the soil is drained, which typically occurs when it is developed for agriculture or urban use. In general, acid sulfate soils become a problem when oxidation products are transported from the soil profile into nearby streams and estuaries, which can severely affect the ecology, biodiversity, economic development, and the aesthetics of adjacent waterways. The key contributors to acidity in drainage waters from the site examined are Al³⁺, AlSO₄⁻ and, under particular circumstances, Mn²⁺ and Fe²⁺, but the principal species contributing to acidity are strongly time variant and would be expected to vary from site to site.