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# ENVIRONMENTAL Science & Technology

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## Aquatic Toxicity Due to Residential Use of PYRETHROID INSECTICIDES

Regulating the Underground  
Injection of CO<sub>2</sub>

Transgenic Plants in  
Phytoremediation



## Critical Review

9377

### Transgenic Plants in Phytoremediation: Recent Advances and New Possibilities

Sam Cherian and M. Margarida Oliveira

Recent research is reviewed on improving plant phytoremediation capacity by applying transgenic approaches, detailing genes, and manipulating traits for organic and inorganic pollutant decontamination.

## Characterization of Natural and Affected Environments

9391

### Perchlorate and Nitrate in Leafy Vegetables of North America

C. A. Sanchez, K. S. Crump, R. I. Krieger, N. R. Khandaker, and J. P. Gibbs

Results of a national survey of perchlorate and nitrate in leafy vegetables are presented and are consistent with findings of earlier studies.

9398

### XAS Evidence of As(V) Association with Iron Oxyhydroxides in a Contaminated Soil at a Former Arsenical Pesticide Processing Plant

B. Cancès, F. Juillot, G. Morin, V. Laperche, L. Alvarez, O. Proux, J.-L. Hazemann, G. E. Brown Jr., and G. Calas

XAS analysis coupled with selective chemical extractions shows that arsenic mainly occurs as As(V) sorbed on amorphous iron oxides all along a contaminated soil profile.

9406

### Atmospheric PCB Concentrations at Terra Nova Bay, Antarctica

Andrea Gambaro, Laura Manodori, Roberta Zangrando, Alessandra Cincinelli, Gabriele Capodaglio, and Paolo Cescon

Concentrations of gas-phase PCBs at Terra Nova Bay (Antarctica) show that long-distance transport is the prevalent factor bringing PCBs to that remote area.

9412

### Development of an Ecosystem Sensitivity Model Regarding Mercury Levels in Fish Using a Preference Modeling Methodology: Application to the Canadian Boreal System

A. Roué-LeGall, M. Lucotte, J. Carreau, R. Canuel, and E. Garcia

A preference modeling methodology that uses simple environmental factors ranks lakes within the boreal forest from highest to lowest mercury concentrations in fish.

Data on respirable particles, CO, and SO<sub>2</sub>, collected over 457 household-days in 4 poor provinces in China, show spatial and temporal patterns of multiple indoor air pollutants from household energy use.

9440

### Spatially Complex Distribution of Dissolved Manganese in a Fjord as Revealed by High-Resolution in Situ Sensing Using the Autonomous Underwater Vehicle Autosub

P. J. Statham, D. P. Connelly, C. R. German, T. Brand, J. O. Overnell, E. Bulukin, N. Millard, S. McPhail, M. Pebody, J. Perrett, M. Squire, P. Stevenson, and A. Webb

Use of an autonomous underwater vehicle and in situ sensors reveals complex distributions of dissolved manganese in coastal waters.

■ 9446

### Identification of Brominated Carbazoles in Sediment Cores from Lake Michigan

Lingyan Zhu and Ronald A. Hites

A group of unknown brominated compounds are identified, the most abundant of which is 1,3,6,8-tetrabromocarbazole. The concentration of this compound peaked around 1920–1935, but its source is unknown.

9452

### Role of Chlorine in Combustion Field in Formation of Polychlorinated Dibenzop-dioxins and Dibenzofurans during Waste Incineration

Takeshi Hatanaka, Akio Kitajima, and Masao Takeuchi

Combustion experiments in which HCl is injected at different locations in the incinerator reveal that the presence of HCl in the main combustion section is essential for formation of PCDDs/Fs.

9457

### Concentrations of Polybrominated Diphenyl Ethers, Polychlorinated Biphenyls, and Polychlorobiphenyls in Serum from Pregnant Faroese Women and Their Children 7 Years Later

Britta Fängström, Lotta Hovander, Anders Bignert, Ioannis Athanassiadis, Linda Linderholm, Philippe Grandjean, Pål Weihe, and Åke Bergman

In children from the Faroese Islands, POP concentrations are mainly due to environmental exposure; children have different PBDE and OH-PCB patterns than their mothers.

9464

### Platinum Group Element Concentrations and Osmium Isotopic Composition in Urban Airborne Particles from Boston, Massachusetts

Sebastien Rauch, Harold F. Hemond, Bernhard Peucker-Ehrenbrink, Kristine H. Ek, and Gregory M. Morrison

Elevated platinum, palladium, rhodium, and osmium concentrations are found in Boston as a result of automobile catalyst emissions.



■ 9478

### XAS Study of Iron and Arsenic Speciation during Fe(II) Oxidation in the Presence of As(III)

S. Thoral, J. Rose, J. M. Garnier, A. van Geen, P. Refait, A. Traverse, E. Fonda, D. Nahon, and J. Y. Bottero

The presence of As(III) limits the formation of Fe(III) oxyhydroxide particles during the oxidation of Fe(II) solutions.

9486

### Enhanced Coagulation Due to Evaporation and Its Effect on Nanoparticle Evolution

M. Z. Jacobson, D. B. Kittelson, and W. F. Watts

The shrinking of emitted particles because of evaporating organics enhances their rates of coagulation; this helps to explain measured particle evolution.

9493

### Speciation of Co(II) and Ni(II) in Anaerobic Bioreactors Measured by Competitive Ligand Exchange-Adsorptive Stripping Voltammetry

Stefan Jansen, Fraukje Steffen, Wim F. Threels, and Herman P. van Leeuwen

The use of CLE-AdSV to analyze cobalt and nickel speciation in anaerobic bioreactors demonstrates their presence in strongly complexed forms.

■ 9500

### ▶ Effect of Microbes on Contaminant Transfer in the Lake Superior Food Web

Matthew J. Hudson, Deborah L. Swackhamer, and James B. Cotner

Microbes bioaccumulate PBTs to a greater extent than phytoplankton do, indicating the potential importance of the microbial loop in trophic transfer.

■ 9509

### Adsorption of Sulfonamide Antimicrobial Agents to Clay Minerals

Juan Gao and Joel A. Pedersen

The adsorption of sulfonamide antimicrobial agents to clay minerals exhibits strong pH dependence consistent with sorbate speciation and clay properties.

■ 9517

### Microcosm Experiments to Assess the Effects of Temperature and Microbial Activity on Polychlorinated Biphenyl Transport in Anaerobic Sediment

Kathleen M. McDonough and David A. Dzombak

Microcosm experiments indicate that temperature and temperature-governed microbial activity—in particular, gas bubble generation—significantly affect PCB transport in anaerobic near-surface sediments.

■ 9523

### Adsorption of Arsenate onto Ferrihydrite from Aqueous Solution: Influence of Media (Sulfate vs. Nitrate) Added

■ 9534

### Is Glassiness a Common Characteristic of Soil Organic Matter?

Julia Hurrass and Gabriele E. Schaumann

Glassiness, a general characteristic of soil organic matter, is distinctly influenced by the soil moisture state.

■ 9541

### Photoirradiation of Dissolved Humic Acid Induces Arsenic(III) Oxidation

Johanna Buschmann, Silvio Canonica, Ursula Lindauer, Stephan J. Hug, and Laura Sigg

The photoinduced oxidation of As(III) to As(V) in the presence of DOM is mainly due to excited triplet states and/or phenoxyl radicals and is an environmentally relevant process.

9547

### Human Cell Mutagens in Respirable Airborne Particles from the Northeastern United States. 2. Quantification of Mutagens and Other Organic Compounds

Daniel U. Pedersen, John L. Durant, Koli Taghizadeh, Harold F. Hemond, Arthur L. Lafleur, and Glen R. Cass

The presence of PAHs and PAH ketones accounts for 16–26% of total mutagenicity at 3 sites on a regional scale (160–500 km) but cannot explain spatial differences in mutagenicity.

■ 9561

### Fluoride Removal by Calcite: Evidence for Fluorite Precipitation and Surface Adsorption

Brett D. Turner, Philip Binning, and S. L. S. Stipp

Fluoride removal from groundwater in the presence of calcite shows that both adsorption and precipitation control the mass of fluoride removed.

9569

### Environmental Microbes Can Speciate and Cycle Arsenic

E. Danielle Rhine, Elizabeth Garcia-Dominguez, Craig D. Phelps, and L. Y. Young

Through oxidative and reductive processes, microorganisms can impact the cycling of arsenic in response to redox changes.

9574

### Interaction Force Profiles between *Cryptosporidium parvum* Oocysts and Silica Surfaces

T. L. Byrd and J. Y. Walz

Direct measurements between individual *C. parvum* oocysts and silica particles display a strong, long-range repulsive force that is essentially independent of ionic strength.

## Environmental Modeling

■ 9583



This study investigates a modal modeling approach for estimating  $\text{NH}_3$  emissions from vehicles under on-road conditions and applies these estimates to emission inventories.

#### ■ 9601

### **Influence of Mobile Air-Conditioning on Vehicle Emissions and Fuel Consumption: A Model Approach for Modern Gasoline Cars Used in Europe**

Martin F. Weilenmann, Ana-Marija Vasic, Peter Stettler, and Philippe Novak

Exhaust emissions and fuel consumption that depend on air-conditioning activity are measured and modeled for Europe.

#### 9611

### **A Quantitative Assay for Linking Microbial Community Function and Structure of a Naphthalene-Degrading Microbial Consortium**

Chang-Ping Yu and Kung-Hui Chu

A new method, called Q-FAST, is developed for concurrent identification and quantification of active naphthalene-degrading microorganisms in microcosms. The technique integrates stable isotope probing into real-time-t-RFLP.

## **Environmental Measurements Methods**

#### ■ 9620

### **Analysis of Atmospheric Sesquiterpenes: Sampling Losses and Mitigation of Ozone Interferences**

Jan Pollmann, John Ortega, and Detlev Helmig

Ozone causes significant depletion of atmospheric sesquiterpenes during sampling on solid adsorbents; techniques for preventing these losses are investigated in detail.

#### 9630

### **Seeing a Deep Ocean $\text{CO}_2$ Enrichment Experiment in a New Light: Laser Raman Detection of Dissolved $\text{CO}_2$ in Seawater**

Rachel M. Dunk, Edward T. Peltzer, Peter M. Walz, and Peter G. Brewer

In situ laser Raman spectroscopy is used to detect aqueous  $\text{CO}_2$  enrichment of a parcel of seawater in direct contact with liquid  $\text{CO}_2$ , similar to what occurs in a seafloor volcanic vent system.

## **Remediation and Control Technologies**

#### 9637

### **Heterogeneous Oxidation of Carbonyl Sulfide on Atmospheric Particles and Alumina**

Hong He, Junfeng Liu, Yujing Mu, Yunbo Yu, and Meixue Chen

OCS can be catalytically oxidized into  $\text{CO}_2$ , surface  $\text{HSO}_3^-$ ,  $\text{HCO}_3^-$ , and  $\text{SO}_4^{2-}$  species via an  $\text{HSCO}_2$  intermediate on atmospheric particles and  $\text{Al}_2\text{O}_3$  at 298 K.

#### 9643

### **Methods for Accelerating Nitrate Reduction Using Zerovalent Iron at Near-Neutral pH: Effects of $\text{H}_2$ -Reducing Pretreatment and Copper Deposition**

#### 9656

### **Impact of Environmental Factors on Efficacy of Upper-Room Air Ultraviolet Germicidal Irradiation for Inactivating Airborne Mycobacteria**

Peng Xu, Elmira Kujundzic, Jordan Peccia, Millie P. Schafer, Gene Moss, Mark Hernandez, and Shelly L. Miller

Upper-room air UV germicidal irradiation for inactivating airborne bacteria is evaluated as a function of relative humidity, UV fluence rate, and room air mixing conditions.

#### 9665

### **Denitrification Mechanism of NaOH in the Presence of Carbon**

Tianji Li, Wataru Minami, and Heejoon Kim

A denitrification process is developed by reacting NaOH and NO in the presence of carbon; during the process, carbon promotes both formation and decomposition reactions of  $\text{NaNO}_3$ .

#### 9669

### **A Model for the Effect of Rhizodeposition on the Fate of Phenanthrene in Aged Contaminated Soil**

R. Kamath, J. L. Schnoor, and P. J. J. Alvarez

A deterministic model is developed to describe how rhizodeposition during phytoremediation affects  $^{14}\text{C}$ -phenanthrene sequestration, bioavailability, and mineralization in soil.

#### ■ 9676

### **Mineral $\text{CO}_2$ Sequestration by Steel Slag Carbonation**

Wouter J. J. Huijgen, Geert-Jan Witkamp, and Rob N. J. Comans

The mechanisms of aqueous steel slag carbonation at elevated  $\text{CO}_2$  pressure and temperature are studied experimentally for the development of a  $\text{CO}_2$  sequestration process.

#### 9683

### **Increasing $\text{Fe}^0$ -Mediated HMX Destruction in Highly Contaminated Soil with Didecyldimethylammonium Bromide Surfactant**

Jeong Park, Steve D. Comfort, Patrick J. Shea, and Jong Sung Kim

This cationic surfactant promotes the iron-mediated destruction of HMX in soil contaminated with solid-phase explosives.

#### ■ 9689

### **Evaluation of Mixed Valent Iron Oxides as Reactive Adsorbents for Arsenic Removal**

Dhananjay Mishra and James Farrell

Several mixed-valent iron oxides are investigated as reactive adsorbent media for removing arsenate from aqueous solutions.

#### 9695

### **Oxidation Mechanism of As(III) in the UV/ $\text{TiO}_2$ System: Evidence for a Direct Hole Oxidation Mechanism**

Sung-Hwan Yoon and Jai H. Lee

A series of  $\text{TiO}_2$ -photocatalyzed As(III) oxidation experiments



O<sub>2</sub> and H<sub>2</sub>O enhance carbothermal reduction of SO<sub>2</sub> at 700 °C because of the CO and H<sub>2</sub> produced from reactions between carbon and O<sub>2</sub> and H<sub>2</sub>O.

#### ■ 9715

### **SO<sub>x</sub> Removal by Calcined MgAlFe Hydrotalcite-like Materials: Effect of the Chemical Composition and the Cerium Incorporation Method**

Manuel Cantú, Esteban López-Salinas, Jaime S. Valente, and Ramón Montiel

Calcined MgAlFe hydrotalcite-like materials containing CeO<sub>2</sub> are used as efficient SO<sub>2</sub>-reducing additives, with the goal of applying this to fluid catalytic cracking units.

#### 9721

### **Amination of *n*-Hexanol in Supercritical Water**

Kiyohiko Tajima, Munehiro Uchida, Kimitaka Minami, Mitsumasa Osada, Kiwamu Sue, Toshiyuki Nonaka, Hideo Hattori, and Kunio Arai

The use of ammonium acetate in supercritical water to amine 1-*n*-hexanol is studied to clarify the reaction pathway, effect of temperature, water density, and substrate concentration.

#### ■ 9725

### **Reduction of Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine by Zerovalent Iron: Product Distribution**

Fanny Monteil-Rivera, Louise Paquet, Annamaria Halasz, Michael T. Montgomery, and Jalal Hawari

HMX is readily degraded by Fe<sup>0</sup> to produce formaldehyde as the main carbon-containing product and NH<sub>4</sub><sup>+</sup>, N<sub>2</sub>H<sub>4</sub>, and N<sub>2</sub>O as the N-containing products.

#### ■ 9732

### **Comparison of the Effects of Sonolysis and $\gamma$ -Radiolysis on Dissolved Organic Matter**

David I. Kreller, Benjamin F. Turner, Ksenija Namjesnik-Dejanovic, and Patricia A. Maurice

Sonolysis and radiolysis impact DOM differently because of the various ways in which they produce and distribute hydroxyl radicals in aqueous solutions.

#### ■ 9738

### **Permeable Membranes Containing Crystalline Silicotitanate As Model Barriers for Cesium Ion**

Andrew M. Warta, William A. Arnold, and Edward L. Cussler

A permeable polymer barrier film containing crystalline silicotitanate dramatically increases the lag time for the diffusive breakthrough of cesium.

#### 9744

### **Adsorption of Hydrogen Sulfide onto Activated Carbon Fibers: Effect of Pore Structure and Surface Chemistry**

Wenguo Feng, Seokjoon Kwon, Eric Borguet, and Radisav Vidic

The importance of carbon surface chemistry, especially basic surface functionalities, on H<sub>2</sub>S retention on activated carbon fibers is shown.

#### ■ 9759

### **Flow of Natural versus Economic Capital in Industrial Supply Networks and Its Implications to Sustainability**

Nandan U. Ukidwe and Bhavik R. Bakshi

Comparing the flow of natural capital, quantified via thermodynamics, with the corresponding economic throughput in industrial sectors provides insight about their sustainability.

#### ■ 9770

### **Parametric Analysis of Environmental Performance of Reused/Recycled Packaging**

C. A. Tsiliyannis

The effects of physical parameters, including lifetime, average and maximum trippage, and annual reuse frequency, on the environmental performance of remanufacturable packaging are analyzed.

## **Ecotoxicology and Human Environmental Health**

#### ■ 9778

### **► Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides**

D. P. Weston, R. W. Holmes, J. You, and M. J. Lydy

Studies with suburban watershed sediments indicate widespread toxicity to an aquatic invertebrate; this is likely because of homeowner use of lawn-care products and exterior application of other pyrethroids.

#### 9785

### **Isolation of the Retinoblastoma cDNA from the Marine Flatfish Dab (*Limanda limanda*) and Evidence of Mutational Alterations in Liver Tumors**

Frances A. du Corbier, Grant D. Stentiford, Brett P. Lyons, and Jeanette M. Rotchell

The retinoblastoma tumor suppressor gene from a marine fish species is isolated, and its mutational profile in environmentally induced tumors is studied.

#### 9791

### **Modulation of Brain Steroidogenesis by Affecting Transcriptional Changes of Steroidogenic Acute Regulatory (StAR) Protein and Cholesterol Side Chain Cleavage (P450<sub>scc</sub>) in Juvenile Atlantic Salmon (*Salmo salar*) Is a Novel Aspect of Nonylphenol Toxicity**

Augustine Arukwe

A novel aspect of nonylphenol toxicity not previously demonstrated in the brain of any fish species or lower vertebrate is described.

#### 9799