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# ENVIRONMENTAL Science & Technology

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## Selenium Biotransformations *in* *an* **Insect ECOSYSTEM**

Analytical Challenges Hamper  
Perfluoroalkyl Research

Brief Survey of EPA Standard-Setting  
and Health Assessment

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## Policy Analysis

■ 3457

### ▶ Brief Survey of EPA Standard-Setting and Health Assessment

Timothy C. Benner

Three components of the U.S. EPA's efforts to protect public health, ambient air quality standards, primary drinking water regulations, and quantitative health benchmarks for chemical substances are examined.

3465

### Life Cycle Assessment for Sustainable Metropolitan Water Systems Planning

Sven Lundie, Gregory M. Peters, and Paul C. Beavis

A case study of Australia's largest water service provider illustrates a prospective LCA methodology for analyzing highly complex water systems.

■ 3474

### Co-control of Urban Air Pollutants and Greenhouse Gases in Mexico City

J. Jáson West, Patricia Osnaya, Israel Laguna, Julia Martínez, and Adrián Fernández

Synergies between controls on urban air pollutants and greenhouse gases are evaluated in Mexico City, creating a comprehensive database of emission control measures and using linear programming.

## Characterization of Natural and Affected Environments

3482

### A 2.5-Year Genotoxicity Profile for a Partially Restored Polluted River

Nanthawan Avishai, Claudette Rabinowitz, and Baruch Rinkevich

A long-term genotoxicity profile of the Kishon River, Israel, reveals chronic genotoxicity reflected through level-dependent seasonality and an improved state following the river restoration.

■ 3488

### Chlordanes in the Mid-Atlantic Atmosphere: New Jersey 1997–1999

John H. Offenberg, Eric D. Nelson, Cari L. Gigliotti, and Steven J. Eisenreich

Observed chlordane concentrations in the New Jersey atmosphere do not correlate with wind direction or air-mass history, which suggests regional volatilization from soils and surfaces.

■ 3498

### Sediment Core Record of Global Fallout and Bikini Close-in Fallout Pu in Sagami Bay, Western Northwest Pacific Margin

Jian Zheng and Masatoshi Yamada

Sediment core records of plutonium activities and atom ratios in Sagami Bay, Japan, reveal that the Bikini close-in fallout Pu reached the eastern Japanese coast.

■ 3505

### Toxicokinetics of PCDD, PCDF, and Coplanar PCB Congeners in Baikal Seals, *Pusa sibirica*: Age-Related Accumulation, Maternal Transfer, and Hepatic Sequestration

Hisato Iwata, Mafumi Watanabe, Yuka Okajima, Shinsuke Tanabe, Masao Amano, Nobuyuki Miyazaki, and Evgeny A. Petrov

This study addresses age-related accumulation, maternal transfer, and hepatic sequestration of PCDD, PCDF, and coplanar PCB congeners in a wild population of Baikal seals.

■ 3514

### Semivolatile Organic Compounds in Window Films from Lower Manhattan after the September 11th World Trade Center Attacks

Craig M. Butt, Miriam L. Diamond, Jennifer Truong, Michael G. Ikonomou, Paul A. Helm, and Gary A. Stern

Surface films collected 6 weeks after 9/11 revealed elevated concentrations of PBDEs, PCBs, PCNs, and PAH within 1 km of the WTC, derived from evaporative and combustion sources.

3525

### Atmospheric Semivolatile Organochlorine Compounds in European High-Mountain Areas (Central Pyrenees and High Tatras)

Barend L. van Drooge, Joan O. Grimalt, Luis Camarero, Jordi Catalan, Evzen Stuchlik, and Carlos J. Torres García

Atmospheric concentrations of semivolatile organochlorine compounds in remote European mountains are higher in summer than in winter because of predominant wind patterns and human activities.

3533

### Occurrence of Antimicrobials in the Final Effluents of Wastewater Treatment Plants in Canada

Xiu-Sheng Miao, Farida Bishay, Mei Chen, and Chris D. Metcalfe

Concentrations of antimicrobial compounds in the final effluents of Canadian municipal sewage treatment plants and their potential for biological effects in surface water are described.

3542

### Chemical Characterization and Sorption Capacity Measurements of Degraded Newsprint from a Landfill

Lixia Chen, Mark A. Nanny, Detlef R. U. Knappe, Travis B. Wagner, and Nopawan Ratasuk

Newsprint degradation in a municipal landfill results in selective preservation of lignin and resin acids and an increasing hydrophobic organic compound sorption capacity.

■ 3551

### Persistent Organic Pollutants at the Base of the Antarctic Marine Food Web

Amy L. Chiuchio, Rebecca M. Dickhut, Michele A. Cochran, and Hugh W. Ducklow

Brominated diphenyl ethers exceed hexachlorobenzene concentrations in Antarctic phytoplankton, but no biomagnification of HCB or BDEs from plankton to krill is observed.

■ 3558

### Groundwater Discharge: Potential Association with Fecal Indicator Bacteria in the Surf Zone

Alexandria B. Boehm, Gregory G. Shellenbarger, and Adina Paytan

Short-lived radium isotopes are used to probe the temporal and spatial variability of saline groundwater discharge at Huntington Beach.

## Environmental Processes

3567

### ▶ Estrogen Content of Dairy and Swine Wastes

D. Raj Raman, Elizabeth L. Williams, Alice C. Layton, Robert T. Burns, James P. Easter, Adam S. Daugherty, Michael D. Mullen, and Gary S. Saylor

Estrogens measured in bovine and swine wastes normalized to macronutrient concentrations are used to estimate estrogen pollution potential of land-applied manure.

■ Supporting Information is available free of charge via the Internet at <http://pubs.acs.org>.

▶ This issue contains a news story about this research.



3574

**Effect of Sorbate Planarity on Environmental Black Carbon Sorption**

Gerard Cornelissen, Marie Elmquist, Inga Groth, and Örjan Gustafsson  
Environmental black carbon with nanoporosity in the <math>4\text{--}10\text{ \AA}</math> range is a more important sorbent for planar compounds than for nonplanar ones.

3581

► **Selenium Biotransformations in an Insect Ecosystem: Effects of Insects on Phytoremediation**

Danel B. Vickerman, John T. Trumble, Graham N. George, Ingrid J. Pickering, and Helen Nichol

Selenium biotransformations in an insect ecosystem are studied to determine the effects of insects on phytoremediation.

3587

**Redox Speciation of Copper in Rainwater: Temporal Variability and Atmospheric Deposition**

Robert J. Kieber, Stephen A. Skrabal, Cliff Smith, and Joan D. Willey

The concentration and temporal variability of copper species are presented for rainwater samples collected in Wilmington, N.C., over a two-year sampling interval.

■ 3595

**Sorption Nonlinearity for Organic Contaminants with Diesel Soot: Method Development and Isotherm Interpretation**

Thanh H. Nguyen, Isam Sabbah, and William P. Ball

An experimentally practical and precise flocculation-based method is developed, tested, and applied to determine phenanthrene and 1,2,4-trichlorobenzene sorption with NIST SRM 2975 diesel particulate matter.

3604

**Using Chromium Stable Isotope Ratios To Quantify Cr(VI) Reduction: Lack of Sorption Effects**

Andre S. Ellis, Thomas M. Johnson, and Thomas D. Bullen

Sorption of Cr(VI) on goethite and alumina causes insignificant isotope fractionation; therefore, Cr-stable isotopes can be used to reliably quantify Cr(VI) reduction.

3608

**Kinetics of Zn Release in Soils and Prediction of Zn Concentration in Plants Using Diffusive Gradients in Thin Films**

Hao Zhang, Enzo Lombi, Erik Smolders, and Steve McGrath

Desorption rate constants for soils freshly amended with Zn are substantially higher than similarly contaminated field soils, making the metal more available.

3614

**Inter-individual Differences in the Ability of Human Milk-Fat Extracts To Enhance the Genotoxic Potential of the Procarcinogen Benzo[a]pyrene in MCF-7 Breast Cells**

Olga I. Kalantzi, Rebecca Hewitt, Kirstie J. Ford, Ruth E. Alcock, Gareth O. Thomas, James A. Morris, Alan Hewer, David H. Phillips, Kevin C. Jones, and Francis L. Martin

The ability of human milk-fat extracts to both induce increases in micronucleus formation and modulate genotoxic potential of the procarcinogen benzo[a]pyrene in MCF-7 cells is studied.

■ 3623

**Deriving Soil Critical Limits for Cu, Zn, Cd, and Pb: A Method Based on Free Ion Concentrations**

Stephen Lofts, David J. Spurgeon, Claus Svendsen, and Edward Tipping

Critical toxic limits for heavy metals in soils may be expressed in terms of the free metal ion and soil pH.

3632

**Relations between Environmental Black Carbon Sorption and Geochemical Sorbent Characteristics**

Gerard Cornelissen, Zofia Kukulska, Stavros Kalaitzidis, Kimon Christanis, and Örjan Gustafsson

Soot and charcoal-like materials are shown to contribute 49–85% of total sediment sorption of phenanthrene in five freshwater sediments at nanogram-per-liter levels.

3641

**Predominance and Mineral Stability Diagrams Revisited**

David G. Kinniburgh and David M. Cooper

A new approach for calculating predominance and mineral stability diagrams using the PHREEQC and the Orchestra chemical speciation programs is discussed.

## Environmental Modeling

3649

**A Model To Estimate Influent and Effluent Concentrations of Estradiol, Estrone, and Ethinylestradiol at Sewage Treatment Works**

Andrew C. Johnson and Richard J. Williams

A method of estimating steroid estrogen concentrations in sewage influent and effluent has been developed that could be a useful tool in predicting endocrine disruption.

■ 3659

**Toxic Ratio as an Indicator of the Intrinsic Toxicity in the Assessment of Persistent, Bioaccumulative, and Toxic Chemicals**

Valérie Maeder, Beate I. Escher, Martin Scheringer, and Konrad Hungerbühler

Indicators for bioconcentration and toxicity should be independent in PBT assessments, and the toxic ratio is proposed as an alternative to the LC50 as toxicity indicator.

■ 3667

**Adsorption of Organic Vapors to Air-Dry Soils: Model Predictions and Experimental Validation**

Kai-Uwe Goss, Johanna Buschmann, and René P. Schwarzenbach

Prediction of sorption of organic compounds from air to soils must account for adsorption to mineral surfaces in addition to absorption in soil organic matter.

## Environmental Measurements Methods

3674

**Electro-oxidation and Amperometric Detection of Chlorinated Phenols at Boron-Doped Diamond Electrodes: A Comparison of Microcrystalline and Nanocrystalline Thin Films**

Grace W. Muna, Natasha Tasheva, and Greg M. Swain

Separation and amperometric detection of phenol and chlorinated phenols in water samples using boron-doped microcrystalline and nanocrystalline diamond thin-film electrodes are described.

3683

**Tedlar Bag Sampling Technique for Vertical Profiling of Carbon Dioxide through the Atmospheric Boundary Layer with High Precision and Accuracy**

Kristen Schulz, Michael L. Jensen, Ben B. Balsley, Kenneth Davis, and John W. Birks

Field data may provide insight into variations of CO<sub>2</sub> fluxes through the use of a powered parachute and a bag sampling technique that is adaptable for profiling in remote areas.



3689

### Compound-Specific Carbon and Hydrogen Isotope Analysis of Sub-Parts per Billion Level Waterborne Petroleum Hydrocarbons

Yi Wang, Yongsong Huang, James N. Huckins, and Jimmie D. Petty

Semipermeable membrane devices allow accumulation of hydrophobic contaminants in a time-integrated manner from polluted water, followed by laboratory recovery for CSIA.

3698

### Automated Solid-Phase Extraction and Measurement of Perfluorinated Organic Acids and Amides in Human Serum and Milk

Zsuzsanna Kuklenyik, John Adam Reich, Jason S. Tully, Larry L. Needham, and Antonia M. Calafat

The automated solid-phase extraction-high-performance liquid chromatography-tandem mass spectrometry method for measuring perfluorinated surfactants in serum and milk is suitable for large epidemiologic studies.

## Remediation and Control Technologies

3705

### Radical Generation by the Interaction of Transition Metals with Common Oxidants

George P. Anipsitakis and Dionysios D. Dionysiou

Determination of reactive metal-oxidant couples and identification of transient species contribute to understanding oxidation-reduction, providing new tools for decontamination of metal-contaminated wastewater.

3713

### Vulnerability of Water Distribution Systems to Pathogen Intrusion: How Effective Is a Disinfectant Residual?

Marco Propato and James G. Uber

Using water-quality modeling, a framework is developed for examining the vulnerability and disinfection capacity to pathogen intrusion in drinking water distribution systems.

3723

### Reduction of Nitroglycerin with Elemental Iron Pathway, Kinetics, and Mechanisms

Seok-Young Oh, Daniel K. Cha, Byung J. Kim, and Pei C. Chiu

Cast iron reduces nitroglycerin rapidly and completely to glycerol and ammonium and represents a promising treatment approach for nitroglycerin-laden wastewaters.

3731

### Effect of Cellulose/Hemicellulose and Lignin on the Bioavailability of Toluene Sorbed to Waste Paper

Ye Chen, Detlef R. U. Knappe, and Morton A. Barlaz

For lignocellulosic waste paper, lignin controls the sorption capacity for organic contaminants, but protein and lipophilic extractives contribute to the sorption capacity of delignified paper.

3737

### Modeling of an Annular Photocatalytic Reactor for Water Purification: Oxidation of Pesticides

Gianluca Li Puma, Jen Nee Khor, and Alberto Brucato

A simple mathematical model is presented for slurry, annular, photocatalytic reactors, which retains the essential elements of a rigorous approach yet provides simple solutions.

3746

### Utilization of Solar Energy in the Photodegradation of Gasoline in Water and of Oil-Field-Produced Water

José Ermírio F. Moraes, Douglas N. Silva, Frank H. Quina, Osvaldo Chivone-Filho, and Cláudio Augusto O. Nascimento

The viability of using solar energy for the photo-Fenton treatment of hydrocarbon-contaminated saline wastewaters is demonstrated.

3752

### Role of Surface Alteration in Determining the Mobility of U(VI) in the Presence of Citrate: Implications for Extraction of U(VI) from Soils

Brian A. Logue, Robert W. Smith, and John C. Westall

Extraction of surface coatings present on a natural iron-rich sand was found to control adsorption of U(VI) in the presence of citrate.

3760

### Speciation of Zinc in Municipal Solid Waste Incineration Fly Ash after Heat Treatment: An X-ray Absorption Spectroscopy Study

Rudolf P. W. J. Struis, Christian Ludwig, Harald Lutz, and André M. Scheidegger

Zinc speciation in thermally treated MSWI fly ash is investigated as a function of temperature using X-ray absorption spectroscopy.

## Sustainability Engineering and Green Chemistry

3768

### Expanding Exergy Analysis to Account for Ecosystem Products and Services

Jorge L. Hau and Bhavik R. Bakshi

This paper presents a thermodynamically rigorous way of accounting for the contribution of natural capital to industrial activity by linking exergy, cumulative exergy, and emergy analysis.

3778

### Origin of Carbon in Polychlorinated Dioxins and Furans Formed during Sooting Combustion

Evalena Wikström, Shawn Ryan, Abderrahmane Touati, Dennis Tabor, and Brian K. Gullett

The role of fly ash and solid- and gas-phase carbon flame precursors in the formation of polychlorinated dibenzo-*p*-dioxins and dibenzofurans during sooting combustion conditions is discussed.

3785

### Construction of a Low-Pressure Microwave Plasma Reactor and Its Application in the Treatment of Volatile Organic Compounds

Yet-Pole I, Yung-Chuan Liu, Kun-Yo Han, and Tien-Chai She

The developing process of a new microwave plasma reactor and its potential use for gaseous pollutant abatement are described.

## Additions and Corrections

3792

### PCDD/F, PCB, HxCBz, PAH, and PM Emission Factors for Fireplace and Woodstove Combustion in the San Francisco Bay Region

Brian K. Gullett, Abderrahmane Touati, and Michael D. Hays

Supporting Information is available free of charge via the Internet at <http://pubs.acs.org>.

This issue contains a news story about this research.