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ENVIRONMENTAL Science & Technology

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SUPERFUND *and Mining* **Megasites**

Environmental Effects of
Emerging Nanotechnologies

Isotopic Fractionation during
Perchlorate Biodegradation

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CHEMICAL SOCIETY

News and Features

2653 Letter

Nitrogen isotopes

NEWS

2654 Fingerprinting perchlorate sources

A new technique identifies the origins of perchlorate even after microbes break it down.

2655 E-waste creates hot spots for POPs

PBDE flame retardants, dioxins, and furans are turning up in soils near primitive e-waste recycling centers in China.

2655-2659 News Briefs

States seek to ban most common flame retardant • Deca PBDEs not needed in TVs, Maine claims • Olive cakes help contain herbicides • DuPont cuts PFOA levels • Pesticides threaten coral reefs • Mercury still rising

2656 Losing the scent of danger

Copper in streams damages young salmon's sense of smell, making them more vulnerable to predators.

2657 Lipid coating increases uptake of nanotubes

Water-soluble nanotubes are easily ingested and structurally modified by water fleas.

2658 Microbes survive in soil with fullerenes

The impact of C_{60} on soil microbial communities may be negligible.

2659 Seeing buckyballs inside human cells

Scientists visualize C_{60} uptake into human macrophage cells.

2660 NIST standardizes household dust

Certified dust samples provide a baseline for evaluating analytical methods.

2660 Chemist wins sustainability award

Abul Hussam is honored for his SONO filter that removes arsenic from drinking water.

INTERVIEW

2661 Spoonful of Caution with Nano Hype

Andrew Maynard speaks about addressing the environmental effects of emerging nanotechnologies.

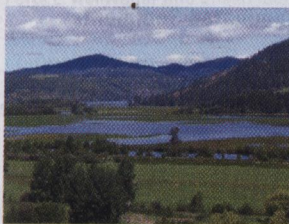
Cover: The photo of the Coeur d'Alene River in Idaho was provided by Joel Riner of Quicksilver Studios.

Online news: Read news first at <http://pubs.acs.org/estnews>.

FEATURE

2667 Superfund and Mining Megasites

Karl E. Gustavson, Lawrence W. Barnhouse, Corale L. Brierley, Edwin H. Clark, II, and C. Herb Ward



Superfund sites can encompass hundreds of square miles and a range of natural environments and human communities. Addressing the contamination at these large complex sites, particularly abandoned hard-rock mining sites, creates tremendous management and financial

issues for the U.S. EPA's Superfund program. Gustavson et al. identify some of the major challenges involved in cleaning up one such mining megasite—the Coeur d'Alene River Basin in Idaho. They emphasize the need for long-term management, appropriate management structures, stable financing, and adaptive management.

Research

CHARACTERIZATION OF NATURAL AND AFFECTED ENVIRONMENTS

■ 2673

Monitoring the Arsenic and Iodine Exposure of Seaweed-Eating North Ronaldsay Sheep from the Gestational and Suckling Periods to Adulthood by Using Horns as a Dietary Archive

Guilhem Caumette, Sairoong Ouypornkochagorn, Charlie M. Scrimgeour, Andrea Raab, and Jörg Feldmann

LA-ICP-MS is used for element mapping, arsenic speciation, and stable isotope analysis to characterize the unusual dietary events of sheep and reveal the accumulation of arsenic and iodine in utero.

■ 2680

Polychlorinated Naphthalenes in the Global Atmospheric Passive Sampling (GAPS) Study

Sum Chi Lee, Tom Harner, Karla Pozo, Mahiba Shoeib, Frank Wania, Derek C. G. Muir, Leonard A. Barrie, and Kevin C. Jones

The global distribution of polychlorinated naphthalenes, including combustion markers, is investigated using PUF-disk passive air samplers.

■ 2688

Hexachlorocyclohexanes in the Canadian Archipelago. 1. Spatial Distribution and Pathways of α -, β -, and γ -HCHs in Surface Water

T. F. Bidleman, H. Kylin, L. M. Jantunen, P. A. Helm, and R. W. Macdonald

Spatial trends in concentrations of HCH isomers and enantiomer fractions of α -HCH in the surface water of the Canadian Archipelago are related to geography and source water contributions.

■ Supporting information is available free at <http://pubs.acs.org/est>.

■ 2696

Identification of Water-Soluble Heavy Crude Oil Organic-Acids, Bases, and Neutrals by Electrospray Ionization and Field Desorption Ionization Fourier Transform Ion Cyclotron Resonance Mass Spectrometry

Lateefah A. Stanford, Sunghwan Kim, Geoffrey C. Klein, Donald F. Smith, Ryan P. Rodgers, and Alan G. Marshall

Heteroatom classes (N, O, and S atoms), rings plus double bonds, and carbon distribution are described for thousands of water-soluble organics in crude oil.

■ 2703

Time Trends in Sources and Dechlorination Pathways of Dioxins in Agrochemically Contaminated Sediments

Minori Uchimiyu and Shigeki Masunaga

Positive matrix factorization reveals in situ lateral dechlorination of highly chlorinated dioxins in sediment cores from Lake Shinji and Tokyo Bay, Japan.

■ 2711

Characterizing and Biological Monitoring of Polycyclic Aromatic Hydrocarbons in Exposures to Diesel Exhaust

Wei Huang, Thomas J. Smith, Long Ngo, Tong Wang, Hongqiao Chen, Fanggu Wu, Robert F. Herrick, David C. Christiani, and Hui Ding

The biological kinetics of pyrene metabolism is studied with a one-compartment pharmacokinetic model among a group of Chinese workers exposed to PAHs in diesel exhaust.

2717

Micrometeorological Measurements of Methane and Carbon Dioxide Fluxes at a Municipal Landfill

Annalea Lohila, Tuomas Laurila, Juha-Pekka Tuovinen, Mika Aurela, Juha Hatakka, Tea Thum, Mari Pihlatie, Janne Rinne, and Timo Vesala

Landfill methane and CO₂ emissions are monitored continuously with an area-integrating method for half a year.

■ 2723

Organochlorine Compounds in Trout from Lakes over a 1600 Meter Elevation Gradient in the Canadian Rocky Mountains

Marc J. Demers, Erin N. Kelly, Jules M. Blais, Frances R. Pick, Vincent L. St. Louis, and David W. Schindler

The effect of altitude on the concentration and composition of organochlorine compounds in trout is investigated along an elevation gradient of 1600 m in the Canadian Rocky Mountains.

■ 2730

Spatial Distribution of Polybrominated Diphenyl Ethers and Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans in Soil and Combusted Residue at Guiyu, an Electronic Waste Recycling Site in Southeast China

Anna O. W. Leung, William J. Luksemburg, Anthony S. Wong, and Ming H. Wong

Crude processing of e-waste has become one of the major contributors of brominated flame retardants and dioxins to the terrestrial environment.

■ 2738

Including Sorption to Black Carbon in Modeling Bioaccumulation of Polycyclic Aromatic Hydrocarbons: Uncertainty Analysis and Comparison to Field Data

Mara Hauck, Mark A. J. Huijbregts, Albert A. Koelmans, Caroline T. A. Moermond, Martine J. Van den Heuvel-Greve, Karin Veltman, A. Jan Hendriks, and A. Dick Vethaak

Uncertainty analyses of a BC-inclusive PAH bioaccumulation model applied to field data illustrate the need for routine yet accurate BC measurements in sediments and soils.

2745

Mercury Speciation in Piscivorous Fish from Mining-Impacted Reservoirs

James S. Kuwabara, Yuji Arai, Brent R. Topping, Ingrid J. Pickering, and Graham N. George

Freshwater, piscivorous fish collected downstream of mining operations that produced or used elemental mercury accumulate methylmercury-cysteine complexes, like marine fish exposed to contrasting mercury sources.

ENVIRONMENTAL PROCESSES

■ 2750

Biosorption of Nonpolar Hydrophobic Organic Compounds to *Escherichia Coli* Facilitated by Metal and Proton Surface Binding

Lin Xiao, Xiaolei Qu, and Dongqiang Zhu

The presence of coexisting transition metals and changes in pH have a major effect on the biosorption of nonpolar HOCs to *E. coli*.

■ 2756

Measurements of the Volatility of Aerosols from α -Pinene Ozonolysis

Charles O. Stanier, Ravi K. Pathak, and Spyros N. Pandis

Organic aerosols from α -pinene ozonolysis at 22 °C condense and evaporate in response to mild temperature ramps, with responses of 4–36% volume change per 10 K.

■ 2764

Biological Reduction of Np(V) and Np(V) Citrate by Metal-Reducing Bacteria

Gary A. Icopini, Hakim Boukhalfa, and Mary P. Neu

The enzymatic reduction of Np(V) and Np(V) citrate by metal-reducing bacteria *Geobacter metallireducens* and *Shewanella oneidensis* is characterized.

■ 2770

The Effects of Plants on the Mobilization of Cu and Zn in Soil Columns

Lu Y. L. Zhao, Rainer Schulin, and Bernd Nowack

Plants have strong local effects on the concentration profiles of DOC, major ions, and metals (Cu and Zn) in soil solution.

■ 2776

Examination of NOM Chlorination Reactions by Conventional and Stop-Flow Differential Absorbance Spectroscopy

Gregory V. Korshin, Mark M. Benjamin, Hyun-Shik Chang, and Hervé Gallard

Differential spectra of chlorinated NOM are demonstrated to contain contributions from at least two different chromophores; the behavior of these chromophores is related to the generation of disinfection byproducts.

■ 2782

Effects of Dissolved Carbonates and Carboxylates on the Sorption of Thiuram Disulfide Pesticides on Humic Acids and Model Surfaces

Panagiota Stathi, Maria Louloudi, and Yiannis Deligiannakis

The effects of dissolved carbonates and carboxylates on the sorption of thiuram disulfide pesticides on humic acids and model surfaces are investigated.

■ 2789

Relative Importance of Solid-Phase Phosphorus and Iron on the Sorption Behavior of Sediments

Jia-Zhong Zhang and Xiao-Lan Huang

Sedimentary phosphorus is much more important than sedimentary iron in regulating the phosphate exchange across the sediment-water interface in carbonate sediments of the Florida Bay.

2796

► **Oxygen and Chlorine Isotopic Fractionation during Perchlorate Biodegradation: Laboratory Results and Implications for Forensics and Natural Attenuation Studies**

Neil C. Sturchio, John Karl Böhlke, Abelardo D. Beloso, Jr., Sheryl H. Streger, Linnea J. Heraty, and Paul B. Hatzinger

Isotopic fractionations of O and Cl during perchlorate biodegradation are determined for two bacterial strains in a laboratory study.

■ 2803

Dicarbonyl Products of the OH Radical-Initiated Reactions of Naphthalene and the C₁- and C₂-Alkyl naphthalenes

Lin Wang, Roger Atkinson, and Janet Arey

The products of the gas-phase hydroxyl radical reactions with naphthalene and a range of alkyl naphthalenes are studied.

■ 2811

Free Zinc Ion and Dissolved Orthophosphate Effects on Phytoplankton from Coeur d'Alene Lake, Idaho

James S. Kuwabara, Brent R. Topping, Paul F. Woods, and James L. Carter

Phytoplankton-growth models are developed to describe Zn-P interactive response by isolates from a P-limited lake draining one of the largest Superfund sites in the U.S.

ENVIRONMENTAL MODELING

■ 2818

Quantifying PM_{2.5} Source Contributions for the San Joaquin Valley with Multivariate Receptor Models

L.-W. Antony Chen, John G. Watson, Judith C. Chow, and Karen L. Magliano

Multivariate receptor models are demonstrated to be applicable to speciation data from multiple sites during the California Regional PM₁₀/PM_{2.5} Air Quality Study for PM_{2.5} source apportionment.

■ 2827

Estimating Enthalpy of Vaporization from Vapor Pressure Using Trouton's Rule

Matthew MacLeod, Martin Scheringer, and Konrad Hungerbühler

The enthalpy of vaporization of nonhydrogen-bonding liquids and subcooled liquids at 298 K can be reliably estimated from vapor pressure.

■ 2833

Screening and Ranking of POPs for Global Half-Life: QSAR Approaches for Prioritization Based on Molecular Structure

Paola Gramatica and Ester Papa

A global persistence index is identified, and a QSAR model is developed to screen environmental persistence and to avoid the synthesis of new POPs.

■ 2840

Relating Atrazine Degradation Rate in Soil to Environmental Conditions: Implications for Global Fate Modeling

Kathrin Fenner, Valentin A. Lanz, Martin Scheringer, and Mark E. Borsuk

Incorporating the dependence of atrazine degradation rate constants on environmental conditions reduces uncertainty in the predictions of a spatially resolved global fate model.

■ 2847

Implementing the Decoupled Direct Method for Sensitivity Analysis in a Particulate Matter Air Quality Model

Bonyoung Koo, Alan M. Dunker, and Greg Yarwood

A method is implemented and tested for determining how particulate matter concentrations predicted by an air-quality model depend on emissions and other model inputs.

■ 2855

Accounting for Intrapopulation Variability in Biogeochemical Models Using Agent-Based Methods

Ferdi L. Hellweg and Ehsan Kianirad

A new agent-based biogeochemical model is presented and compared with a conventional lumped-system model.

ENVIRONMENTAL MEASUREMENTS METHODS

■ 2861

► **Development of a House Dust Standard Reference Material for the Determination of Organic Contaminants**

Dianne L. Poster, John R. Kucklick, Michele M. Schantz, Stacy S. Vander Pol, Stefan D. Leigh, and Stephen A. Wise

A critically needed indoor dust reference material will be useful for investigations on indoor contaminant health effects and toxicity testing.

■ 2868

Small-Angle Neutron Scattering Study of Natural Aquatic Nanocolloids

Helen P. Jarvie and Stephen M. King

The potential of small-angle neutron scattering as a tool for studying the nanostructure of natural freshwater aquatic colloids is examined.

■ 2874

Near-Infrared Spectroscopy (NIRS) of Epilithic Material in Streams has a Potential for Monitoring Impact from Mining

Jan Persson, Mats Nilsson, Christian Bigler, Stephen J. Brooks, and Ingemar Renberg

Spectroscopy of material that covers stones in streams is a useful method for environmental monitoring.

2881

Methylene Blue Dye Test for Rapid Qualitative Detection of Hydroxyl Radicals Formed in a Fenton's Reaction Aqueous Solution

Andrea Y. Satoh, James E. Trosko, and Susan J. Masten

A new test qualitatively indicates the presence of hydroxyl radicals through an immediate distinct bleaching of methylene blue dye on a paper test strip.

■ 2888

Development of a Luminex Based Competitive Immunoassay for 2,4,6-Trinitrotoluene (TNT)

George P. Anderson, Jacqueline D. Lamar, and Paul T. Charles

A competitive immunoassay for TNT is demonstrated on the Luminex flow cytometer; this method enables rapid screening for numerous compounds of environmental concern.

■ Supporting information is available free at <http://pubs.acs.org/est>.

► This issue contains a news story about this research.

REMEDIATION AND CONTROL TECHNOLOGIES

2894

Simultaneous Removal of SO₂ and Trace As₂O₃ from Flue Gas: Mechanism, Kinetics Study, and Effect of Main Gases on Arsenic Capture

Yuzhong Li, Huiling Tong, Yuqun Zhuo, Yan Li, and Xuchang Xu

As₂O₃ and CaO interact to form calcium arsenate between 600 and 1000 °C; between 400 and 1000 °C the ability of CaO to absorb As₂O₃ increases with temperature.

■ 2901

Development of Engineered Natural Organic Sorbents for Environmental Applications: 3. Reducing PAH Mobility and Bioavailability in Contaminated Soil and Sediment Systems

Jixin Tang, Elijah J. Petersen, Qingguo Huang, and Walter J. Weber, Jr.

The effects of engineered natural organic sorbent (ENOS) amendments on reduction of the environmental "availability" of soil- and sediment-associated PAH compounds are determined, and their application potentials are discussed.

■ 2908

Photocatalytic Degradation of Two Volatile Fatty Acids in an Annular Plug-Flow Reactor; Kinetic Modeling and Contribution of Mass Transfer Rate

Pierre-François Biard, Abdelkrim Bouzaza, and Dominique Wolbert

The influence of inlet concentration and flow rate on the degradation rate of butyric and propionic acids is investigated using TiO₂-coated nonwoven fiber textile as the photocatalyst.

■ 2915

Electron and Carbon Balances in Microbial Fuel Cells Reveal Temporary Bacterial Storage Behavior During Electricity Generation

Stefano Freguia, Korneel Rabaey, Zhiguo Yuan, and Jürg Keller

The fate of carbon and electrons in microbial fuel cells is studied through detailed balances and reveals growth and storage patterns by anodophilic bacteria.

2922

Surfactants Differentially Impact *p,p'*-DDE Accumulation by Plant and Earthworm Species

Jason C. White, Richard Peters, and Jason W. Kelsey

Surfactant-mediated increases in DDE bioavailability to zucchini and earthworms are species- and cultivar-specific; contaminant accumulation by one worm species increases 74-fold.

■ 2930

Phytochelatins and Antioxidant Systems Respond Differentially during Arsenite and Arsenate Stress in *Hydrilla verticillata* (L.f.) Royle

S. Srivastava, S. Mishra, R. D. Tripathi, S. Dwivedi, P. K. Trivedi, and P. K. Tandon

Plants of *H. verticillata* show significant tolerance to arsenate and arsenite and may therefore find applications in phytoremediation of arsenic-contaminated aquatic bodies.

■ 2937

A Novel Electro-Fenton Process for Water Treatment: Reaction-controlled pH Adjustment and Performance Assessment

Hong Liu, Chuan Wang, Xiangzhong Li, Xiaoli Xuan, Chengchun Jiang, and Hua'nan Cui

The performance of the three-step process is assessed in terms of dimethyl phthalate degradation in aqueous solution.

■ 2943

Sequential Capture of CO₂ and SO₂ in a Pressurized TGA Simulating FBC Conditions

Ping Sun, John R. Grace, C. Jim Lim, and Edward J. Anthony

Four processes for SO₂ and CO₂ capture, based on fluidized-bed co-combustors by use of calcium-based sorbents, are studied.

2950

Vitrification of Chromium Electroplating Sludge

Chun-Teh Li, Wen-Jhy Lee, Kuo-Lin Huang, Sheng-Feng Fu, and Yi-Chieh Lai

Vitrification, with or without addition of bottom ash or cullet, is studied to explore whether hazardous electroplating sludge can be made into nonhazardous recyclable products.

■ 2957

Evaluation of Volatile Hydrocarbon Emission Characteristics of Carbonaceous Additives in Green Sand Foundries

Yujue Wang, He Huang, Fred S. Cannon, Robert C. Voigt, Sridhar Komarneni, and James C. Furness

Hydrocarbon emissions during pyrolysis of four carbonaceous additives—a highly volatile bituminous coal, anthracite, lignite, and cellulose—are characterized and compared.

SUSTAINABILITY ENGINEERING AND GREEN CHEMISTRY

2964

Transformation of Polycyclic Aromatic Hydrocarbons by Laccase Is Strongly Enhanced by Phenolic Compounds Present in Soil

Ana I. Cañas, Miguel Alcalde, Francisco Plou, María Jesús Martínez, Angel T. Martínez, and Susana Camarero

Several natural phenolic compounds enhance anthracene, benzo[*a*]pyrene, and pyrene transformation by laccase; the outstanding efficiency of *p*-coumaric acid as laccase mediator for PAH removal is revealed.

ECOTOXICOLOGY AND HUMAN ENVIRONMENTAL HEALTH

■ 2972

Dredging Associated Effects: Maternally Transferred Pollutants and DNA Adducts in Feral Fish

Henrik Sundberg, Marsha Hanson, Birgitta Liewenborg, Yngve Zebühr, Dag Broman, and Lennart Balk

Dredging causes increased DNA damage in feral fish, and maternally transferred sediment pollutants contribute to adverse effects in the early life stages of fish.

2978

Effects of Ambient NO_x on Chlorophyll *a* Fluorescence in Transplanted *Flavoparmelia caperata* (Lichen)

Mauro Tretiach, Massimo Piccotto, and Laurence Baruffo

Chlorophyll *a* fluorescence applied to lichen transplants is a very informative tool for biomonitoring studies when standardized conditions are applied.

2985

► Impact of Fullerene (C₆₀) on a Soil Microbial Community

Zhonghua Tong, Marianne Bischoff, Loring Nies, Bruce Applegate, and Ronald F. Turco

The impact of manufactured nanomaterials (C₆₀) on soil microbial functions is assessed.

■ 2992

Zinc Toxicity to Nitrification in Soil and Soilless Culture Can Be Predicted with the Same Biotic Ligand Model

Jelle Mertens, Fien Degryse, Dirk Springael, and Erik Smolders

Zn toxicity to the nitrification process in soils and in soilless solutions depends on pH and concentrations of Ca and Mg in solution; toxic concentrations can be predicted for both systems, indicating exposure of microorganisms to Zn through the soil pore water.

■ 2998

A Sensory System at the Interface between Urban Stormwater Runoff and Salmon Survival

Jason F. Sandahl, David H. Baldwin, Jeffrey J. Jenkins, and Nathaniel L. Scholz

Dissolved copper interferes with olfaction and olfactory-mediated predator avoidance behaviors in juvenile coho salmon.

3005

Common Pattern of Gene Expression in Response to Hypoxia or Cadmium in the Gills of the European Glass Eel (*Anguilla anguilla*)

Fabien Pierron, Magalie Baudrimont, Patrice Gonzalez, Jean-Paul Bourdineaud, Pierre Elie, and Jean-Charles Massabuau

Cadmium exposure triggers a similar genetic response to hypoxia in gills of the postlarval stage of the European glass eel (*A. anguilla*).

3012

Visualizing the Uptake of C₆₀ to the Cytoplasm and Nucleus of Human Monocyte-Derived Macrophage Cells Using Energy-Filtered Transmission Electron Microscopy and Electron Tomography

Alexandra E. Porter, Mhairi Gass, Karin Muller, Jeremy N. Skepper, Paul Midgley, and Mark Welland

C₆₀ enters both cytoplasm and nuclei of macrophage cells during in vitro exposure, and energy-filtered transmission

electron microscopy and electron tomography enhance its visualization.

3018

Simple and Easy Method to Evaluate Uptake Potential of Nanoparticles in Mammalian Cells Using a Flow Cytometric Light Scatter Analysis

Hiroshi Suzuki, Tatsushi Toyooka, and Yuko Ibuki

The uptake potential of nanoparticles in mammalian cells can be evaluated using flow cytometric light scatter analysis.

3025

In vivo Biomodification of Lipid-Coated Carbon Nanotubes by *Daphnia magna*

Aaron P. Roberts, Andrew S. Mount, Brandon Seda, Justin Souther, Rui Qiao, Sijie Lin, Pu Chun Ke, Apparao M. Rao, and Stephen J. Klaine

D. magna can modify the solubility of lysophospholipid-coated carbon nanotubes in water.

ADDITIONS AND CORRECTIONS

3030

Evaluation of Urinary Methoxyphenols as Biomarkers of Woodsmoke Exposure

Russell L. Dills, Michael Paulsen, Jacqui Ahmad, David A. Kalman, Fady N. Elias, and Christopher D. Simpson

3030

Are There Other Persistent Organic Pollutants? A Challenge for Environmental Chemists

Derek C. G. Muir and Philip H. Howard

- Supporting information is available free at <http://pubs.acs.org/est>.
- ▶ This issue contains a news story about this research.