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ENVIRONMENTAL Science & Technology

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News and Features

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The environmental engineering and science paradox: can we solve big problems with small investments?

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Closing the phosphorus loop from intensive livestock farms

NEWS

5168 Rewarding fertilizer pollution with crop subsidies

A new study follows the money to nitrate hot spots in the U.S. Midwest.

5169 Order matters in pesticide exposures

Risk assessments should consider order of exposure when it comes to mixtures.

5169-5173 News Briefs

Nano needs oversight • Revisiting dredging • Congress and carbon sequestration • Low-cost greenhouse-gas controls • Sowing carbon credits • Cities for sustainability

5170 EPA releases list of potential endocrine disrupters

Critics say the long-awaited list of chemicals and assays leaves much to be desired.

5171 Consensus reached on prenatal exposures

A consensus statement, penned by scientists from five continents, targets pervasive chemicals.

5172 Unleashing a dioxin legacy

Decades-old sediments in the Houston Ship Channel are likely responsible for high dioxin levels in aquatic organisms.

5173 Florida gators battle pesticides

The poor survival rates of alligator eggs are linked to lingering toxic chemicals in lakes.

5174 Lead levels high in Canadian tap water

Highly corrosive water combined with treatments to reduce

FEATURE

■ 5176 Environmental Trade-offs of Biobased Production

Shelie A. Miller, Amy E. Landis, and Thomas L. Theis



Biobased products are commonly thought of as environmentally preferable to petroleum alternatives because they are derived from renewable materials; however, a holistic approach must be taken that examines the environmental impacts throughout a product's entire life cycle. By critically examining biobased systems and understanding the societal and environmental implications associated with large-scale bioproduct substitution, it may be possible to avoid or anticipate potentially detrimental effects and determine appropriate management strategies and policy initiatives. Miller et al. examine the inherent trade-offs of biobased production, with an emphasis on carbon and nitrogen cycles related to agriculture.

Research

CHARACTERIZATION OF NATURAL AND AFFECTED ENVIRONMENTS

5183

An Emission Inventory of Marine Vessels in Shanghai in 2003

Dong-qing Yang, Stephanie H. Kwan, Tao Lu, Qing-yan Fu, Jian-min Cheng, David G. Streets, Ya-ming Wu, and Jin-ju Li

An air-pollutant emission inventory developed for marine vessels in the Shanghai Port in 2003 reveals significant contributions of NO_x and SO_2 .

■ 5191

Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species

Brenden E. McNeil, Jane M. Read, and Charles T. Driscoll

Tree species increase foliar N along a regional N deposition gradient and appear to differ in this response according to

Xiang Ding, Xin-ming Wang, Zhou-qing Xie, Cai-hong Xiang, Bi-xian Mai, Li-guang Sun, Mei Zheng, Guo-ying Sheng, and Jia-mo Fu

This study reports the spatial pattern and chiral signatures of atmospheric HCHs over the North Pacific Ocean and the Arctic area in summer 2003.

5210
Occupational Exposure to Hexabromocyclododecane at an Industrial Plant

Cathrine Thomsen, Paal Molander, Hanne L. Daae, Karel Janák, May Froshaug, Veronica H. Liane, Syvert Thorud, Georg Becher, and Erik Dybing

Occupational exposure to HBCD among workers at an industrial plant has been assessed by both air and biomonitoring methods.

5217
Identifying Sources of Nitrogen to Hanalei Bay, Kauai, Utilizing the Nitrogen Isotope Signature of Macroalgae

Elizabeth Derse, Karen L. Knee, Scott D. Wankel, Carol Kendall, Carl J. Berg, Jr., and Adina Paytan

Nitrogen isotope signatures of macroalgae in Hanalei Bay, Kauai, implicate fertilizer runoff as the major external source of nitrogen to the bay.

5224
Metal Emissions from Brake Linings and Tires: Case Studies of Stockholm, Sweden 1995/1998 and 2005

David S. T. Hjortenkrans, Bo G. Bergbäck, and Agneta V. Häggerud

Metal emissions from brake linings and tires in 1995/1998 and 2005 in Stockholm are calculated to discuss changes in major metal emission sources in urban areas.

5231
Influence of the Large Grid Size Used in a Multimedia Mass Balance Model (POPsME) on the Exposure Assessment of Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans

Yunah Lee, Gyutak Cho, Dong Soo Lee, Jee Yoon Lee, Yoon Kwan Kim, Dong Won Kim, Su Jin Kim, Kyungmin Kim, Gilho Jang, and Seungpil Choi

The prediction bias caused by the use of a large grid with a homogeneous mixing assumption is scrutinized for a multimedia mass balance model.

5237
Anthropogenic and Naturally Occurring Organobrominated Compounds in Fish Oil Dietary Supplements

Adrian Covaci, Stefan Voorspoels, Walter Vetter, Anke Gelbin, Philippe G. Jorens, Ronny Blust, and Hugo Neels

The intake of PBDEs from fish oil dietary supplements is lower than that from fish.

5245

lake to follow water circulation and the propagation of microbial contaminants from three point sources.

5259
Evidence for Control of Mercury Accumulation Rates in Canadian High Arctic Lake Sediments by Variations of Aquatic Primary Productivity

P. M. Outridge, H. Sanei, G. A. Stern, P. B. Hamilton, and F. Goodarzi

Lake-sediment-based estimates of anthropogenic Hg deposition in the Arctic may be confounded by climate-related increases in aquatic primary productivity.

5266
Identification of Iron-Cyanide Complexes in Contaminated Soils and Wastes by Fourier Transform Infrared Spectroscopy

Thilo Rennert, Stephan Kaufhold, and Tim Mansfeldt

FTIR spectroscopy is an effective tool to identify diverse species of iron-cyanide complexes in contaminated soils and wastes originating from different sources.

5271
Perfluorinated Compounds in the Cape Fear Drainage Basin in North Carolina

Shoji Nakayama, Mark J. Strynar, Laurence Helfant, Peter Egeghy, Xibiao Ye, and Andrew B. Lindstrom

A new analytical method for emerging persistent organic compounds in surface water is evaluated in a pilot-scale survey of a North American watershed.

ENVIRONMENTAL PROCESSES

5277
Particle Size and Aggregation Effects on Magnetite Reactivity toward Carbon Tetrachloride

Peter J. Vikesland, April M. Heathcock, Robert L. Rebodos, and K. Erik Makus

Magnetite reactivity toward CCl_4 is studied as a function of particle size and aggregation state.

5284
Effect of Natural Organic Matter on Zinc Inhibition of Hematite Bioreduction by *Shewanella putrefaciens* CN32

James J. Stone, Richard A. Royer, Brian A. Dempsey, and William D. Burgos

Me(II)-NOM complexes inhibit the biological hematite reduction through the formation of ternary Me(II)-NOM-hematite complexes.

5291
Dioxin Chronology and Fluxes in Sediments of the Houston Ship Channel, Texas: Influences of Non-Steady-

■ 5306

Natural Attenuation Processes during In Situ Capping

David W. Himmelheber, Kurt D. Pennell, and Joseph B. Hughes

Laboratory-scale experiments demonstrate that in situ capping may lead to reductions in contaminant bioattenuation in aquatic sediments because of electron donor limitations.

■ 5314

Quinoline and Derivatives at a Tar Oil Contaminated Site: Hydroxylated Products as Indicator for Natural Attenuation?

Anne-Kirsten Reineke, Thomas Göen, Alfred Preiss, and Juliane Hollender

The ratio of metabolics to parent compounds is shown as a suitable indicator for biological natural attenuation processes in groundwater for the *N*-heterocycles quinoline and isoquinoline.

■ 5323

Biogeochemistry of Metalliferous Peats: Sulfur Speciation and Depth Distributions of *dsrAB* Genes and Cd, Fe, Mn, S, and Zn in Soil Cores

Carmen Enid Martínez, Carolina Yáñez, Soh-joung Yoon, and Mary Ann Bruns

Artificial drainage of peatlands results in distinct elemental and microbiological signatures that indicate redox stratification zones and lead to downward mobility of Cd and Zn.

■ 5330

Influence of a Modification of the Petcoke/Coal Ratio on the Leachability of Fly Ash and Slag Produced from a Large PCC Power Plant

Maria Izquierdo, Oriol Font, Natalia Moreno, Xavier Querol, Frank E. Huggins, Esther Alvarez, Sergi Diez, Pedro Otero, Juan Carlos Ballesteros, and Antonio Gimenez

An increase in the petcoke/coal ratio in the feed fuel blend does not drastically modify the overall chemical composition and leachability of co-fired fly ash and slag.

■ 5336

Mechanistic Study and the Influence of Oxygen on the Photosensitized Transformations of Microcystins (Cyanotoxins)

Weihua Song, Sabrina Bardowell, and Kevin E. O'Shea

Microcystins undergo rapid phototransformation in the presence of phycocyanin under solar simulated conditions; photosensitized isomerization plays a major role, and oxygen inhibits the process.

■ 5342

Continuous Analysis of Dissolved Gaseous Mercury and Mercury Volatilization in the Upper St. Lawrence River: Exploring Temporal Relationships and UV Attenuation

N. J. O'Driscoll, L. Poissant, J. Canário, J. Ridal, and D. R. S. Lean

Increasing fluorotelomer alcohol chain length increases sorption and similarly decreases solubility, which primarily follows the expected cavity formation energy associated with molar volume.

5363

Effect of Acidity on Secondary Organic Aerosol Formation from Isoprene

Jason D. Surratt, Michael Lewandowski, John H. Offenberg, Mohammed Jaoui, Tadeusz E. Kleindienst, Edward O. Edney, and John H. Seinfeld

SOA formation from isoprene is shown to be linearly correlated with increasing aerosol acidity in a multistage laboratory chamber study.

■ 5370

Role of Divalent Cations in Plasmid DNA Adsorption to Natural Organic Matter-Coated Silica Surface

Thanh H. Nguyen and Kai Loon Chen

The adsorption kinetics of supercoiled and linear plasmid DNA onto a NOM-coated silica surface are studied in the presence of common divalent electrolytes CaCl_2 and MgCl_2 .

■ 5376

Interactions of Aqueous Selenium (–II) and (IV) with Metallic Sulfide Surfaces

Aude Naveau, Fanny Monteil-Rivera, Emmanuel Guillon, and Jacques Dumonceau

Macroscopic data combined with spectroscopic analyses show the formation of (di)selenide species onto metallic sulfide minerals.

5383

Cadmium Accumulation in *Scenedesmus vacuolatus* under Freshwater Conditions

Stefanie Töpferwien, Hanbin Xue, Renata Behra, and Laura Sigg

Cadmium accumulation in a freshwater alga exposed to various freshwater samples depends on several factors besides speciation.

■ 5389

Binding of Pyrene to Hydrophobic Fractions of Dissolved Organic Matter: Effect of Polyvalent Metal Complexation

Tamara Polubesova, Michal Sherman-Nakache, and Benny Chefetz

The presence of polyvalent cations significantly increases pyrene binding to the hydrophobic acid fraction (HoA) of DOM because of formation of HoA pseudomicelles.

■ 5395

Biotransformation of the Polycyclic Musks HHCB and AHTN and Metabolite Formation by Fungi Occurring in Freshwater Environments

Claudia Martin, Monika Moeder, Xavier Daniel, Gudrun Krauss, and Dietmar Schlosser

Biotransformations catalyzed by fungi occurring in freshwater environments may influence the fate of the polycyclic musk

5410

► Spring Nitrate Flux in the Mississippi River Basin: A Landscape Model with Conservation Applications

Mary S. Booth and Chris Campbell

Nitrate loading in the Mississippi River basin is modeled to estimate the contribution of agricultural N runoff, and expansion of federal conservation programs is proposed to reduce nitrate flux.

ENVIRONMENTAL MEASUREMENTS METHODS

5419

Emerging Technologies for Identification of Disinfection Byproducts: GC/FT-ICR MS Characterization of Solvent Artifacts

Caleb Heffner, Indira Silwal, John M. Peckenharn, and Touradj Solouki

GC/FT-ICR mass spectra provide high mass measurement accuracy and auxiliary data for characterization of method artifacts and authentic DBPs at high levels of confidence.

■ 5426

Comparative Quantitative Prevalence of *Mycobacteria* and Functionally Abundant *nidA*, *nahAc*, and *nagAc* Dioxygenase Genes in Coal Tar Contaminated Sediments

Jennifer M. DeBruyn, Christopher S. Chewning, and Gary S. Saylor

Low- and high-molecular-weight bacterial PAH-catabolism genes, including *Mycobacterium* pyrene dioxygenase (*nidA*), are enriched at the PAH-contaminated Chattanooga Creek Superfund Site (Chattanooga, Tenn.).

5433

Ferrioxalate–Polyoxometalate System as a New Chemical Actinometer

Jaesang Lee, Jungwon Kim, and Wonyong Choi

An aqueous solution of ferrioxalate and polyoxometalate is proposed as a new chemical actinometer that determines the UV light intensity (300–390 nm) simply and rapidly without the need for any postirradiation analytical procedure.

■ 5439

Real-Time, Single-Particle Measurements of Oligomers in Aged Ambient Aerosol Particles

Kerri A. Denkenberger, Ryan C. Moffet, John C. Holecek, Thomas P. Rebotier, and Kimberly A. Prather

The detection of oligomeric species in single ambient submicrometer aerosol particles using real-time single-particle mass spectrometry is presented; consideration is given to factors affecting oligomerization.

■ 5447

An Innovative Microelectrode Fabricated Using Photolithography for Measuring Dissolved Oxygen Distributions in Aerobic Granules

Chao-Yang Liu, Gang Liu, Yang-Chao Tian, You-Fang Chen, Han-Qing Yu,

remediation of a range of contaminants in groundwater is investigated.

5460

Effect of Ultraviolet Germicidal Irradiation on Viral Aerosols

Christopher M. Walker and GwangPyo Ko

UV-C air disinfection of pathogenic viral aerosols for the prevention of indoor airborne transmission is investigated.

5466

Concentration of Soluble and Nonsoluble Zinc-Based Impurities by Unidirectional Freezing: Basis for a Method of Sludges Treatment

Guillaume Gay and Aza Azouni

A new technique to make metallic contaminants migrate is applied to purify model contaminated sludges consisting of clayey suspensions charged with zinc.

5471

Adsorption and Photocatalyzed Oxidation of Methylated Arsenic Species in TiO₂ Suspensions

Tielian Xu, Yong Cai, and Kevin E. O'Shea

The mineralization of monoethylarsonic acid and dimethylarsonic acid by TiO₂ photocatalysis occurs rapidly and appears to happen via hydroxyl-radical-mediated reactions.

■ 5478

Activated Carbon Load Equalization of Gas-Phase Toluene: Effect of Cycle Length and Fraction of Time in Loading

William M. Moe, Kodi L. Collins, and John D. Rhodes

An evaluation is presented of the effects of cycle length and fraction of time that contaminants are supplied on the degree of load equalization achieved by passively operated granular activated carbon beds.

■ 5485

Dissolved Organic Nitrogen as a Precursor for Chloroform, Dichloroacetonitrile, *N*-Nitrosodimethylamine, and Trichloronitromethane

Wontae Lee, Paul Westerhoff, and Jean-Philippe Croué

The formation of three nitrogen-containing disinfection byproducts (N-DBPs) (dichloroacetonitrile, trichloronitromethane, and *N*-nitrosodimethylamine) and one regulated DBP (chloroform) is studied.

■ 5491

Regeneration of Sulfur-Fouled Bimetallic Pd-Based Catalysts

Brian P. Chaplin, John R. Shapley, and Charles J. Werth

The regeneration of sulfide-fouled Pd–In catalysts with NaOCl can restore catalyst activity for nitrate reduction without compromising the catalyst surface.

coal being considered as feedstock for a large IGCC plant to be built in Australia.

■ **5510**
Investigation of the Reduction of Lead Dioxide by Natural Organic Matter

Deborah J. Dryer and Gregory V. Korshin

The reduction of lead dioxide solid by NOM dramatically increases the concentration of lead in water.

SUSTAINABILITY ENGINEERING AND GREEN CHEMISTRY

■ **5515**
Input-Dependent Life-Cycle Inventory Model of Industrial Wastewater-Treatment Processes in the Chemical Sector

Annette Köhler, Stefanie Hellweg, Ercan Recan, and Konrad Hungerbühler

Input-dependent life-cycle inventories for industrial wastewater-treatment processes allow for environmental performance assessment and, thereby, provide input for the decision-making process concerning technology choices.

5523
Cost Structure of a Postcombustion CO₂ Capture System Using CaO

J. Carlos Abanades, G. Grasa, M. Alonso, N. Rodriguez, E. J. Anthony, and L. M. Romeo

Postcombustion CO₂ capture using CaO is a low-cost emerging technology that doubles the CO₂ output of an oxy-fired CFBC plant with low efficiency penalty.

ECOTOXICOLOGY AND HUMAN ENVIRONMENTAL HEALTH

■ **5528**
Simulating Toxicity of Carbaryl to *Gammarus pulex* after Sequential Pulsed Exposure

Roman Ashauer, Alistair B. A. Boxall, and Colin D. Brown

A process-based and an empirical model are compared; total recovery time for three pesticides and other exotoxicological implications are briefly discussed.

5535
▶ **Modeling Combined Effects of Pulsed Exposure to Carbaryl and Chlorpyrifos on *Gammarus pulex***

Roman Ashauer, Alistair B. A. Boxall, and Colin D. Brown

The sequence of exposure to environmental toxicants does matter, and the effects can be predicted by toxicokinetic modeling.

5542
Gastrointestinal Microbes Increase Arsenic Bioaccessibility of Ingested Mine Tailings Using the Simulator of the Human Intestinal Microbial Ecosystem

Brian D. Laird, Tom R. Van de Wiele, Madeleine C. Corriveau, Heather E. Jamieson, Michael B. Parsons, Willy Verstraete, and Steven D. Siciliano

Arsenic concentration, particle size, and the activity of gastrointestinal microbes are all determining factors of arsenic bioaccessibility.

■ **5548**
Revisiting the Cape Cod Bacteria Injection Experiment Using a Stochastic Modeling Approach

Reed M. Maxwell, Claire Welty, and Ronald W. Harvey

A 3D, stochastic reinterpretation of a subsurface bacterial transport experiment provides a robust estimate of the observations and insight into the role of local-scale parameterizations on field-scale transport.

■ **5559**
▶ **Parental Exposure to Pesticides and Poor Clutch Viability in American Alligators**

R. Heath Rauschenberger, Jon J. Wiebe, Maria S. Sepúlveda, Janet E. Scarborough, and Timothy S. Gross

In central Florida, parental exposure to organochlorine pesticides likely explains some, but not all, of the low clutch viability observed in alligators inhabiting polluted habitats.

■ **5564**
Systemic Uptake of Diethyl Phthalate, Dibutyl Phthalate, and Butyl Paraben Following Whole-Body Topical Application and Reproductive and Thyroid Hormone Levels in Humans

Nadeem Rezaq Janjua, Gerda Krogh Mortensen, Anna-Maria Andersson, Brian Kongshoj, Niels E. Skakkebaek, and Hans Christian Wulf

After topical application, diethyl phthalate, dibutyl phthalate, and butyl paraben are systemically absorbed; in the short term, this absorption does not influence levels of reproductive and thyroid hormones.

5571
Short and Long Term Toxicity of Crude Oil and Oil Dispersants to Two Representative Coral Species

Shai Shafir, Jaap Van Rijn, and Baruch Rinkevich

Nubbin assays that evaluate impacts of dispersed oil fractions from six commercial dispersants on >10,000 coral fragments negate the use of dispersants near coral reefs.

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