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ENVIRONMENTAL Science & Technology

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**Maternal Diet During
Oogenesis** *Is the
Major Source of
METHYLMERCURY* *in
Fish Embryos*

**Environmental Programs: Liberal Arts
Colleges and Interdisciplinary Education**

**Elevated Microbial Tolerance to Metals and
Antibiotics in Industrial Environments**

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Critical Review

3409

Sonochemistry in Environmental Remediation. 1. Combinative and Hybrid Sonophotochemical Oxidation Processes for the Treatment of Pollutants in Water

Yusuf G. Adewuyi

An overview of the fundamentals of ultrasound and a critical review of the environmental remediation applications of sono-photochemical oxidation are presented.

Characterization of Natural and Affected Environments

3421

Screening of Human Antibiotic Substances and Determination of Weekly Mass Flows in Five Sewage Treatment Plants in Sweden

Richard H. Lindberg, Patrik Wennberg, Magnus I. Johansson, Mats Tysklind, and Barbro A. V. Andersson

The occurrence of 12 antibiotics in 5 sewage treatment plants in Sweden is determined, and the correlations with theoretical-predicted mass flows are shown.

■ 3430

Occurrence of Synthetic Musk Fragrances in Marine Mammals and Sharks from Japanese Coastal Waters

Haruhiko Nakata

Synthetic musk fragrances (HHCb and AHTN) accumulate in marine mammals and sharks; this suggests that they are less degradable in aquatic environments.

3435

Colloid-Facilitated Transport of Cesium in Variably Saturated Hanford Sediments

Gang Chen, Markus Flury, James B. Harsh, and Peter C. Lichtner

A variable amount of cesium is stripped off mobile colloids during transport in the vadose zone; the amount depends on the water saturation of the medium.

3443

Concentration and Particle Size of Airborne Toxic Algae (Brevetoxin) Derived from Ocean Red Tide Events

Yung Sung Cheng, Jacob D. McDonald, Dean Kracko, C. Mitch Irvin, Yue Zhou, Richard H. Pierce, Michael S. Henry, Andrea Bourdelais, Jerome Naar, and Daniel G. Baden

An LC/MS/MS method is developed to detect and quantify brevetoxins in marine aerosol, which is correlated to the respiratory problems of exposed people during red-tide blooms.

3450

Unexpected Arsenic Compounds in Low-Rank Coals

Zdenka Šlejkovec and Tjaša Kanduč

Organoarsenic compounds (tetramethylarsonium ion, arsenobetaine, trimethylarsine oxide, monomethylarsonic, and dimethylarsinic acid) are discovered in low-rank coals.

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■ 3455

PCBs and Selected Organochlorine Compounds in Italian Mountain Air: The Influence of Altitude and Forest Ecosystem Type

Foday M. Jaward, Antonio Di Guardo, Luca Nizzetto, Chiara Cassani, Francesca Raffaele, Rossella Ferretti, and Kevin C. Jones

Air concentrations of PCBs in three forest types in Alpine mountain sites are lower than in the adjacent clearings; this shows the air-depletion ability of forests.

3464

Enantiomer Fractions of Organic Chlorinated Pesticides in Arctic Marine Ice Fauna, Zooplankton, and Benthos

Katrine Borga and Terry F. Bidleman

The influence of habitat, geographic area, and diet on selective bioaccumulation of the (-) and (+) enantiomers of chiral chlorinated pesticides is investigated.

■ 3474

Polybrominated Diphenyl Ethers in the Sediments of the Great Lakes. 2. Lakes Michigan and Huron

Wenlu Song, An Li, Justin C. Ford, Neil C. Sturchio, Karl J. Rockne, Dave R. Buckley, and William J. Mills

Dramatic increases in PBDE concentrations and fluxes after the 1970s are observed; the inventory of PBDEs appears to depend on the proximity of the location to populated areas.

■ 3480

Loosely Bound Oxytetracycline in Riverine Sediments from Two Tributaries of the Chesapeake Bay

N. S. Simon

Sediments from tributaries to the Chesapeake Bay contain easily desorbed oxytetracycline, which was determined by extraction with magnesium chloride solutions and analyzed by HPLC with electrochemical detection.

■ 3488

Brominated Flame Retardants in Sediment Cores from Lakes Michigan and Erie

Lingyan Y. Zhu and Ronald A. Hites

The deposition history of PBDEs and one polybrominated biphenyl congener is studied with dated sediment cores from the Great Lakes.

■ 3495

Environmental Stresses and Skeletal Deformities in Fish from the Willamette River, Oregon

Daniel L. Villeneuve, Lawrence R. Curtis, Jeffrey J. Jenkins, Kara E. Warner, Fred Tilton, Michael L. Kent, Virginia G. Watral, Michael E. Cunningham, Douglas F. Markle, Doolalai Sethajintanin, Oraphin Krissanakriangkrai, Eugene R. Johnson, Robert Grove, and Kim A. Anderson

Trematode parasites are identified as the primary cause of skeletal deformities detected in fish from the Willamette River.

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

3507

Comparative Investigation of Low-Molecular-Weight Fulvic Acids of Different Origin by SEC-Q-TOF-MS: New Insights into Structure and Formation

Thorsten Reemtsma and Anja These

Electrospray-mass spectrometry reveals that low-molecular-weight fulvic acids in isolates of very different origin consist of a large set of identical molecules.

■ 3513

Congener-Specific Tissue Distribution of Aroclor 1254 and a Highly Chlorinated Environmental PCB Mixture in Rats

Izabela Kania-Korwel, Keri C. Hornbuckle, Aaron Peck, Gabriele Ludewig, Larry W. Robertson, Wieslaw W. Sulkowski, Parvaneh Espandari, C. Gary Gairola, and Hans-Joachim Lehmler

Multivariate analysis of PCB profiles from rats exposed to two different PCB mixtures reveals differences between the mixtures in the tissue distribution of individual congeners.

■ 3521

Distribution of Polybrominated Diphenyl Ethers in Sediments of the Pearl River Delta and Adjacent South China Sea

Bixian Mai, Shejun Chen, Xiaojun Luo, Laiguo Chen, Qingshu Yang, Guoying Sheng, Pingan Peng, Jiamo Fu, and Eddy Y. Zeng

Spatial and temporal distributions are examined of PBDEs in sediments of the Pearl River Delta and adjacent South China Sea of southern China.

■ 3528

Dissolved Trace Element Concentrations in the East River-Long Island Sound System: Relative Importance of Autochthonous versus Allochthonous Sources

Nathaniel J. Buck, Christopher J. Gobler, and Sergio A. Sañudo-Wilhelmy

Nutrient levels and distributions and major seasonal processes influence dissolved metals in the surface waters of Long Island Sound.

■ 3538

Long-Term Recovery of PCB-Contaminated Sediments at the Lake Hartwell Superfund Site: PCB Dechlorination. 1. End-Member Characterization

Victor S. Magar, Glenn W. Johnson, Richard C. Brenner, John F. Quensen, III, Eric A. Foote, Greg Durell, Jennifer A. Ickes, and Carole Peven-McCarthy

Congener fingerprinting and multivariate receptor modeling (polytopic vector analysis) are used to identify and characterize source and dechlorination PCB end-member patterns in Lake Hartwell sediments.

■ 3548

Long-Term Recovery of PCB-Contaminated Sediments at the Lake Hartwell Superfund Site: PCB Dechlorination. 2. Rates and Extent

Victor S. Magar, Richard C. Brenner, Glenn W. Johnson, and John F. Quensen, III

In situ PCB dechlorination rates in Lake Hartwell sediments are determined from linear regressions of meta plus para chlorines/PCB versus sediment age in sediment cores.

3555

Traffic as a Source of Organophosphorus Flame Retardants and Plasticizers in Snow

Anneli Marklund, Barbro Andersson, and Peter Haglund

Road vehicles, aircraft, and long-range air transport are identified as major sources of organophosphates in the outdoor environment.

■ 3563

Tracking Sources of Unsaturated Zone and Groundwater Nitrate Contamination Using Nitrogen and Oxygen Stable Isotopes at the Hanford Site, Washington

Michael J. Singleton, Katharine N. Woods, Mark E. Conrad, Donald J. DePaolo, and P. Evan Dresel

Nitrogen and oxygen isotopes in nitrate are used to distinguish natural and industrial sources in unsaturated zone and groundwater at the Hanford Site in Washington.

Environmental Processes

3571

Arsenate Adsorption Structures on Aluminum Oxide and Phyllosilicate Mineral Surfaces in Smelter-Impacted Soils

Brett T. Beaulieu and Kaye S. Savage

Particulate arsenic oxides from a copper smelter experience oxidation, dissolution, and limited vertical migration in downwind inceptisols; arsenic forms bridging bidentate structures.

3580

▶ Maternal Diet During Oogenesis Is the Major Source of Methylmercury in Fish Embryos

Chad R. Hammerschmidt and Mark B. Sandheinrich

Maternal diet during oogenesis—not methylmercury remobilized from parental somatic tissue—is the principal source of methylmercury in fish eggs.

3585

▶ Effects of Mercury on Neurochemical Receptors in Wild River Otters (*Lontra canadensis*)

Niladri Basu, Anton Scheuhammer, Nicole Grochowina, Kate Klenavic, Douglas Evans, Mike O'Brien, and Hing Man Chan

Neurochemical receptors are novel biomarkers of mercury exposure and effects in wild river otters.

■ 3592

Interaction Forces between Colloids and Protein-Coated Surfaces Measured Using an Atomic Force Microscope

Li-Chong Xu and Bruce E. Logan

The effect of a protein on colloidal adhesion between uncoated and protein-coated colloids and surfaces in the presence of four different proteins is examined.

3601

Effect of Airflow Setting on the Organic Composition of Woodheater Emissions

Timothy B. Jordan and Andrew J. Seen

As the airflow is closed, emission factors for organic compounds emitted from woodheaters increase for most particle-phase compounds, while levoglucosan varies relatively little.

3611

Hepatic CYP1A Induction by Dioxin-Like Compounds, and Congener-Specific Metabolism and Sequestration in Wild Common Cormorants from Lake Biwa, Japan

Akira Kubota, Hisato Iwata, Shinsuke Tanabe, Kumiko Yoneda, and Sachiko Tobata

Functional roles of cytochrome P450 1A protein associated with concentration profiles and tissue distribution of dioxin-like congeners in wild cormorants are extensively investigated.

3620

Spatial Distributions of *Cryptosporidium* Oocysts in Porous Media: Evidence for Dual-Mode Deposition

Nathalie Tufenkji and Menachem Elimelech

Observed deviation of *Cryptosporidium* deposition behavior from classical filtration theory is attributed to the influences of secondary-minimum deposition and surface-charge heterogeneities.

■ 3630

Triplet-Sensitized Photodegradation of Sulfa Drugs Containing Six-Membered Heterocyclic Groups: Identification of an SO₂ Extrusion Photoproduct

Anne L. Boreen, William A. Arnold, and Kristopher McNeill

The photodegradation mechanism of a class of sulfa drugs containing six-membered heterocyclic substituents is investigated in a natural water sample.

3639

Persistence and Biodegradation of Monoethanolamine and 2-Propanolamine at an Abandoned Industrial Site

Steven B. Hawthorne, Alena Kubátová, John R. Gallagher, James A. Sorensen, and David J. Miller

Alkanolamines persist for many years on soils at an abandoned industrial site and do not appear to transport to groundwater.

■ 3646

Photochemical Transformations of Benzo[*e*]pyrene in Solution and Adsorbed on Silica Gel and Alumina Surfaces

Silvina Fioressi and Rafael Arce

Photodegradation of benzo[*e*]pyrene is influenced by the microenvironment polarity; this finding shows the importance of studying the photodegradation of organic pollutants in different environments.

3656

Photochemical Production of Ionic and Particulate Aluminum and Iron in Lakes

Jiří Kopáček, Šárka Klementová, and Stephen A. Norton

Mass budgets and laboratory experiments suggest that photochemical liberations of organically bound aluminum and iron are important sources of their ionic forms in lakes.

3663

Long-Term Fate of Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons in an Agricultural Soil

Kieron J. Doick, Eva Klingelmann, Peter Burauel, Kevin C. Jones, and Kirk T. Semple

Two aged lysimeter soils show different patterns of fate and behavior for PAHs and PCBs in an Orthic Luvisol over 12 years.

3671

Elevated Microbial Tolerance to Metals and Antibiotics in Metal-Contaminated Industrial Environments

Ramunas Stepanauskas, Travis C. Glenn, Charles H. Jagoe, R. Cary Tuckfield, Angela H. Lindell, and J. V. McArthur

Trace-element-rich ash settling basins of coal-fired power plants harbor microbial communities with elevated tolerance to metals and antibiotics.

3679

Spatial Variation in Deposition Rate Coefficients of an Adhesion-Deficient Bacterial Strain in Quartz Sand

Meiping Tong, Terri A. Camesano, and William P. Johnson

A nonelectrostatic mechanism is demonstrated to drive deviation from filtration theory of profiles of retained adhesion-deficient bacteria in quartz sand.

3688

Sorption to Black Carbon of Organic Compounds with Varying Polarity and Planarity

Gerard Cornelissen, Joris Haftka, John Parsons, and Örjan Gustafsson

Strong sorption to black carbon is observed for nonplanar hexachloroethane, butylate, and diuron but not for atrazine.

3695

Direct Observation of Organic Contaminant Uptake, Storage, and Metabolism within Plant Roots

Edward Wild, John Dent, Gareth O. Thomas, and Kevin C. Jones

Visualization of the uptake movement and degradation of xenobiotics within plant roots are discussed.

■ 3703

Estrogenic Activity of Impurities in Industrial Grade Bisphenol A

Masanori Terasaki, Fujio Shiraiishi, Tomohiro Nishikawa, John S. Edmonds, Masatoshi Morita, and Masakazu Makino

Impurities in industrial grade bisphenol A do not significantly raise the estrogenicity of the impure compound above that of the pure reagent.

3708

Use of Superoxide as an Electron Shuttle for Iron Acquisition by the Marine Cyanobacterium *Lyngbya majuscula*

Andrew L. Rose, Tim P. Salmon, Tredwell Lukondeh, Brett A. Neilan, and T. David Waite

Superoxide is generated by the cyanobacterium *Lyngbya majuscula* and appears to facilitate iron uptake by reduction to the ferrous state.

Environmental Modeling

■ 3716

In-Stream Nitrogen Attenuation: Model-Aggregation Effects and Implications for Coastal Nitrogen Impacts

Amélie Darracq and Georgia Destouni

Differing spatial process and parameter aggregation procedures in catchment-scale nitrogen-budget models may yield different rate magnitude and depth-dependence behavior, with practically important management implications.

3723

Percutaneous Absorption of 4-Cyanophenol from Freshly Contaminated Soil in Vitro: Effects of Soil Loading and Contamination Concentration

G. D. Touraille, K. D. McCarley, A. L. Bunge, J.-P. Marty, and R. H. Guy

Because dermal exposure to contaminated soil may influence health, the rate and extent of dermal penetration relative to soil loading and degree of contamination are characterized.

3732

Computer Model for Municipal Solid Waste Treatment in Developing Countries

Amit Jain, Harsangeet Kaur, and Sunil Khanna

The computer model attempts to minimize overall system cost and to identify low-cost alternatives by calculating energy recovery for various disposal options.

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

Environmental Measurements Methods

■ 3736

Solid-Phase Dosing and Sampling Technique To Determine Partition Coefficients of Hydrophobic Chemicals in Complex Matrixes

Thomas L. ter Laak, Mojca Durjava, Jaap Struijs, and Joop L. M. Hermens

A simple solid-phase dosing and sampling technique for the determination of sorption coefficients of hydrophobic compounds to dissolved organic matter is presented.

3743

Evaluation of Air Acidity through Optical Sensors

M. Garcia-Heras, K. Kromka, J. Faber, P. Karaszkiwicz, and M. A. Villegas

Optical sensors developed from dye-doped coatings obtained through the sol-gel method are produced to evaluate the air acidity.

3748

Development of an Immunoassay for the Determination of Polyaromatic Hydrocarbons in Plasma Samples from Oiled Seabirds

G. M. Troisi and L. Borjesson

A commercially available immunoassay is developed and validated by GC-MS for determination of total PAHs in avian plasma.

3756

Miniaturized Lead Sensor Based on Lead-Specific DNAzyme in a Nanocapillary Interconnected Microfluidic Device

In-Hyoung Chang, Joseph J. Tulock, Juewen Liu, Won-Suk Kim, Donald M. Cannon, Jr., Yi Lu, Paul W. Bohn, Jonathan V. Sweedler, and Donald M. Cropek

A combination of a DNAzyme molecular beacon with nanofluidic-microfluidic architecture creates a sensitive and specific sensor for lead in water.

Remediation and Control Technologies

3762

Evaluating Factors Affecting the Permeability of Emulsions Used To Stabilize Radioactive Contamination from a Radiological Dispersal Device

Garey A. Fox and Victor F. Medina

Postdetonation decontamination with the use of emulsions, asphalt, or tall oil pitch to stabilize contamination released by a radiological dispersal device is evaluated.

3770

Preparation of Titania Nanotubes and Their Environmental Applications as Electrode

Xie Quan, Shaogui Yang, Xiuli Ruan, and Huiming Zhao

The structural and surface morphology of a TiO₂ nanotube-like electrode is described, and its pentachlorophenol degradation efficiency is compared with that of a TiO₂ film electrode.

■ 3776

▶ Silicate-Enhanced Enzymatic Dehairing: A New Lime-Sulfide-Free Process for Cowhides

Subramani Saravanabhavan, Palanisamy Thanikaivelan, Jonnalagadda Raghava Rao, and Balachandran Unni Nair

Use of silicate in the enzymatic dehairing improves the catalytic efficiency of the enzyme and provides an eco-benign lime-sulfide-free dehairing process for bovine hides.

■ 3784

Effects of pH and Catalyst Concentration on Photocatalytic Oxidation of Aqueous Ammonia and Nitrite in Titanium Dioxide Suspensions

Xingdong Zhu, Sunny R. Castleberry, Mark A. Nanny, and Elizabeth C. Butler

Optimization of photocatalytic oxidation requires pH control to increase the fraction of NH₄⁺/NH₃ in the form of NH₃ and sufficient TiO₂ for complete oxidation of NO₂ and NO₃.

3792

Occurrence, Sources, and Fate of Benzothiazoles in Municipal Wastewater Treatment Plants

Achim Kloepper, Martin Jekel, and Thorsten Reemtsma

Polar benzothiazoles occur in household wastewater, street runoff, and municipal wastewater, and their total concentration is hardly diminished by activated-sludge wastewater treatment.

3799

Elucidation of Degradation Mechanism of Dioxins during Mechanochemical Treatment

Yugo Nomura, Satoshi Nakai, and Masaaki Hosomi

Model dioxin compounds, including 4-chlorobiphenyl, octachlorodibenzo-*p*-dioxin, and octachlorodibenzofuran, are degraded by a mechanochemical process.

3805

Electrochemical Oxidation for Low Concentration of Aniline in Neutral pH Medium: Application to the Removal of Aniline Based on the Electrochemical Polymerization on a Carbon Fiber

Minako Matsushita, Hideki Kuramitz, and Shunitz Tanaka

A new method for removal of low concentrations of aniline in water is developed on the basis of the electropolymerization of aniline at a carbon-fiber electrode.

3811

Influence of the Order of Reagent Addition on NDMA Formation during Chloramination

I. Marie Schreiber and William A. Mitch

The order of reagent addition during chloramination can significantly impact NDMA formation via dichloramine formation or chlorination of organic nitrogen precursors.

3819

Continuous Fermentative Hydrogen Production Using a Two-Phase Reactor System with Recycle

Jeremy T. Kraemer and David M. Bagley

A two-phase anaerobic microbial reactor system converts glucose to hydrogen and methane and, with recycle, significantly reduces the alkali needed for hydrogen-reactor pH control.

3826

(*E*)-5-[2-(Methoxycarbonyl)ethenyl]cytidine as a Chemical Actinometer for Germicidal UV Radiation

Chengyue Shen, Shiyue Fang, Donald E. Bergstrom, and Ernest R. Blatchley, III

(*E*)-5-[2-(Methoxycarbonyl)ethenyl]cytidine is examined for use as a chemical actinometer for germicidal UV radiation.

3833

Preparation and Evaluation of GAC-Based Iron-Containing Adsorbents for Arsenic Removal

Zhimang Gu, Jun Fang, and Baolin Deng

An innovative arsenic adsorbent (As-GAC) is developed and characterized in terms of arsenic removal capacity and SEM and BET analyses.

3844

Reactivation of a Commercial Diesel Oxidation Catalyst by Acid Washing

Francisco Cabello Galisteo, Rafael Mariscal, Manuel López Granados, José Luis García Fierro, Pilar Brettes, and Oscar Salas

Citric acid washing successfully regenerates a vehicle-aged diesel oxidation catalyst.

■ 3849

Iron(VI) and Iron(V) Oxidation of Copper(I) Cyanide

Virender K. Sharma, Christopher R. Burnett, Ria A. Yngard, and Diane E. Cabelli

$\text{Fe}^{\text{VI}}\text{O}_4^{2-}$ efficiently oxidizes copper(I) cyanide to less harmful products with subsequent coagulation of copper, and $\text{Fe}^{\text{VO}}\text{O}_4^{2-}$ reacts much faster than $\text{Fe}^{\text{VI}}\text{O}_4^{2-}$.

3855

Novel Incineration Technology Integrated with Drying, Pyrolysis, Gasification, and Combustion of MSW and Ashes Vitrification

Yangsheng Liu and Yushan Liu

A novel incineration technology is integrated with municipal solid waste drying, pyrolysis, gasification, combustion, and ash vitrification processes.

3864

Influence of Flocculation and Adsorption as Pretreatment on the Fouling of Ultrafiltration and Nanofiltration Membranes: Application with Biologically Treated Sewage Effluent

H. K. Shon, S. Vigneswaran, R. Ben Aim, H. H. Ngo, In S. Kim, and J. Cho

The fouling of membrane treatment processes by effluent organic matter can be significantly reduced through the introduction of pretreatment, such as flocculation and adsorption.

3872

Thermal Degradation of PCDD/F in Municipal Solid Waste Ashes in Sealed Glass Ampules

Lisa Lundin and Stellan Marklund

The influence of temperature, residence time, and atmosphere on the degradation of PCDD/F in fly ashes with different compositions is investigated.

Sustainability Engineering and Green Chemistry

3878

Exergy-Based Efficiency and Renewability Assessment of Biofuel Production

J. Dewulf, H. Van Langenhove, and B. Van De Velde

To determine the contribution of three different biofuels to sustainability, their production is assessed in terms of efficiency and renewability by energy analysis.

Correspondence and Rebuttal

3883

Comment on "Detection of Perfluorooctane Surfactants in Great Lakes Water" and "Mass Budget of Perfluorooctane Surfactants in Lake Ontario"

Jennifer A. Field, Staci Simonich, and Douglas Barofsky

3885

Response to Comment on "Detection of Perfluorooctane Surfactants in Great Lakes Water" and "Mass Budget of Perfluorooctane Surfactants in Lake Ontario"

Bryan Boulanger, Keri C. Hornbuckle, Jerald L. Schnoor, John Vargo, and Aaron M. Peck

Additions and Corrections

3887

Use of Personal-Indoor-Outdoor Sulfur Concentrations to Estimate the Infiltration Factor and Outdoor Exposure Factor for Individual Homes and Persons

Lance Wallace and Ron Williams

3887

Comparison between Back-Trajectory-Based Modeling and Lagrangian Backward Dispersion Modeling for Locating Sources of Reactive Gaseous Mercury

Young-Ji Han, Thomas M. Holsen, Philip K. Hopke, Seung-Muk Yi

3888

Detachment-Influenced Transport of an Adhesion-Deficient Bacterial Strain within Water-Reactive Porous Media

Meiping Tong, Xiqing Li, Christina N. Brow, and William P. Johnson

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