China-US Symposium on Environmental Science and Pollution Control

(International Nexus of Food, Energy, Water, and Soil)

October 27-29, 2016

Table of Content

Introduction of Conference

The 2016China-US Joint Annual Symposium

"International Nexus of Food, Energy, Water, and Soil"

October 26-29, 2016, Yixing, Jiangsu Province, China

"Celebrating the Tenth Anniversary of the China-US Joint Research Center"

2006—Build and Explore—2016

Keynote Speaker: Dr. Warren Washington, Awarded the 2010 U.S. National Medal of Science

INTRODUCTION

Climate change, urbanization, population growth, and accelerating consumption of energy and natural resources bring great challenges for regional and global sustainable development. It is becoming imperative how society can best integrate across the natural and built environments to provide a growing demand for food, energy and water while maintaining key ecosystem functions and services. The U.S. and China have the largest economies and drive the rates and patterns of global resource utilization, energy consumption, and environmental degradation. The US and China share responsibility for developing realistic goals, effective strategies, and practical protocols for the best solutions for global energy, climate, food, and environmental problems that transform the production and use of limited energy and ecosystem resources. Sustainable development is dependent on these two nations exchanging perspectives to develop a joint agenda for international solutions to future needs, and lead the world in implementing innovative technologies. China and the U.S. share important experiences in tackling environmental problems encountered in the history of economic and social development. A mutual lesson-learning between the U.S. and China at the levels of science, technology, and policy could help both countries and other nations to avoid risks and create opportunities for developing joint efforts to tackle uncertain challenges. US-China collaboration can create new economic opportunities through technology development, transfer and commercialization within the goals of clean and sustainable development—a realization of a series of bilateral environment and energy agreements signed at the annual meetings of the US-China Strategic Economic Dialogue (SED).

The China-US Joint Research Center for Ecosystem and Environmental Change (JRCEEC) (http://jrceec.utk.edu/) was established in 2006 to enhance collaboration among Chinese and U.S. scientists to address the combined effects of climate change and human activities on regional and global ecosystems and to explore technologies for the restoration of degraded environments. The Center's partners include the University of Tennessee (UT), Oak Ridge National Laboratory (ORNL), Purdue University, two institutes within the Chinese Academy of Sciences (CAS) (Geographic Sciences and Natural Resources Research and the Research Center for Eco-Environmental Sciences), and the University of Science and Technology of China (USTC). In May 2011, a JRCEEC-based new partnership with joining of CAS' Institute of Applied Ecology, the US-China Ecopartnership for Environmental Sustainability (USCEES), was approved by the U.S. Department of State and the Chinese National Development and Reform Commission (NDRC) within the framework of the US-China Strategic and Economic Dialogue. Nanjing University was accepted into the USCEES in 2015. The JRCEEC and USCEES jointly promote research collaboration, academic exchange, student education, and technology training and transfer in all areas of food, energy and environmental concern.

Introduction of Conference

SYMPOSIUM GOALS AND OBJECTIVES

The symposium organizers work to develop an integrative research, education, and industry business agenda for securing food production, producing clean energy, protecting water resources, and improving soil productivity while developing economy and social wellbeing. Specifically, conference sessions and panel discussions will address the following topics:

- **Research Workshop**: Science and Technology for Sustainability—Promoting adaptation to climate change, pollution control, soil remediation, healthy food production, watershed nutrients management, groundwater protection, biomass utilization, wastes treatment/recycling, and ecological safety
- **Education Workshop**: Knowledge and Growth for Leadership—Creating the world-best model for joint PhD and scholar exchange programs with integration of research collaboration among faculty and student researchers
- **Industry Workshop**: Partnership and Innovation for Services—Launching a US-China industry network for sustainability-targeted cooperation in the areas of agriculture, environment, energy, resources, ecology, sustainable construction, and eco-tourism

INTRODUCTION OF PARTNERSHIPS

The economies of the US and China are the globally dominant drivers of energy consumption, agricultural productivity, land use change, urban waste generation, and greenhouse gas emissions. Thus, despite their differences in terms of natural resources, economies, energy use, political structure, and culture, these two countries are linked in their concern over global climate change and in their goal of sustainable development of renewable energy sources and bio-industry. Both countries are shaping ambitious long-term plans for addressing environmental and energy problems at multiple levels in the areas of policy, science, and the economy. However, innovative and transformational science, engineering, and technology will require collaboration between the public and private sectors and mutually beneficial policies and incentives to help actualizing solutions tailored to the economic and social needs of both nations.

China-US Joint Center for Ecosystem and Environmental Change (JRCEEC)

In 2006, in parallel with the creation of the China-US Strategic Economic Dialogue (SED) created by Presidents Hu Jintao and George W. Bush, scientists in China and the US signed a framework agreement establishing the China-US Joint Research Center for Ecosystem and Environmental Change (http://jrceec.utk.edu). Partnering organizations include: University of Tennessee-Oak Ridge National Laboratory’s (UT-ORNL) Joint Institute for Biological Sciences (JIBS), UT’s Institute for a Secure and Sustainable Environment (ISSE), Purdue University’s Center for the Environment, the Institute of Geographic Science and Natural Resources Research (IGSNRR) and the Research Center for Eco-Environmental Science (RCEES) of the Chinese Academy of Sciences (CAS), and the Anhui Key Laboratory of Biomass Clean Energy at the University of Science and Technology of China (USTC). Among its goals, the Joint Center seeks to promote research collaboration, academic exchange, student education, and technology training and transfer in the areas of environmental concern. Collaborative themes include ecosystem processes and management, bioenergy sustainability, water resources and quality, and technologies for improvement of eco-environmental systems. This year is the ten years anniversary of JRCEEC. With the efforts in the past decade, JRCEEC has engaged more than 1,200 Chinese and US scientists from more than 40 institutions through international workshops, field site visits, and exchange programs for students and junior/senior researchers. Particularly, the regular engagements with governmental agencies (such as National Science Foundation, Environmental Protection Agency, Department of Energy of the US, Natural Science Foundation and Ministry of Science and Technology of China, and the Embassies of US and China) greatly promote the mutual understanding and their awareness of the unique, complementary resources and capabilities possessed by the joint center partners.

Introduction of Partnerships

US-China EcoPartnership for Environmental Sustainability (USCEES)

In May of 2011 the US Department of State and the National Development and Reform Commission of China approved a proposal to establish a US-China EcoPartnership for Environmental Sustainability (http://www.purdue.edu/discoverypark/ecopartnership) that builds on the success of the JRCEEC. The EcoPartnership's overall mission was summarized at http://blogs.state.gov/index.php/site/entry/us_china_ecopartnershipsby the US Secretary of State Hillary Clinton at the 2011 ceremony for the appointment of the most recent EcoPartnership members. The EcoPartnership is a collaboration among Purdue University's Global Sustainability Initiative, UT's ISSE, UT-ORNL JIBS of the US and the CAS institutes including IGSNRR, RCEES, and the Institute of Applied Ecology (IAE). The EcoPartnership serves as a conduit between scientists and decision makers at the highest levels in the US and China, and coordinates scientific activities and accelerates information and technology exchange among the members to generate more effective policy, technology and research solutions for the interconnected challenges of environmental sustainability, climate change, and energy security. Along with existing collaborations within the China-US Joint Research Center for Ecosystem and Environmental Change (http://jrceec.utk.edu), this bi-national partnership includes Centers within Purdue University's Global Sustainability Initiative, the University of Tennessee-Oak Ridge National Laboratory's (UT-ORNL) Joint Institute for Biological Sciences (JIBS), UT's Institute for a Secure and Sustainable Environment (ISSE), Institute of Geographic Science and Natural Resources Research (IGSNRR), Research Center for Eco-Environmental Science (RCEES), and Institute of Applied Ecology (IAE) of the Chinese Academy of Sciences (CAS), and the University of Science and Technology of China (USTC).

The JRCEEC and USCEES jointly promote research collaboration, academic exchange, student education, and technology training and transfer in all areas of food, energy and environmental concern.

Nanjing University and Its Relationship with USCEES

Founded in 1902, Nanjing University is one of the oldest and most prestigious institutions of higher learning in China. With the motto of 'Sincerity with Aspiration, Perseverance and Integrity,' this university carries the spirit of constant striving for educational and academic excellence. In the past 105 years, Nanjing University has cultivated a great number of talents, contributing greatly to the national prosperity and the revitalization of the Chinese nation.

Through recent years' development, this century-old university has gained new and vital vigor while meeting unprecedented historical challenges and opportunities. Currently we have three campuses: Gulou in the city center, Pukou on the northern bank of the Yangtze River, and Xianlin International Campus in the east suburb of the city.

As a key comprehensive university with an array of outstanding faculty members, it has enjoyed coordinated development in humanities, social sciences, natural sciences, technological sciences, life sciences, modern engineering and management and so on. In the meantime, it has continuously improved quality of teaching, research, social service and all other areas. According to different rankings and in terms of various indexes of academic strength and comprehensive academic performance, Nanjing University is always one of the leading universities in China.

In 1999 and 2006, Nanjing University was chosen in the first group of a limited number of high-level research universities for prioritized support by the Central Government of China under the '985 Project'. Our mission is to build this university into a world renowned institution enjoying an international reputation and maintaining our own academic characteristics. We aim to be a cradle for preparing innovative talents for the future, a frontier for activities giving insight to the unknown world, seeking truth, providing scientific grounds for solving important problems encountered by humanity; we aim to be an important source of innovation and technology transfer and a bridge for cooperation and exchange between different cultures and civilizations. These beliefs well fit the objectives of USCEES, thus Nanjing University made great efforts to take part in USCEES and was accepted into the USCEES in 2015.

School of the Environment at Nanjing University

As one of the earliest institutions dedicating to environmental education and research in China, the School of the Environment at Nanjing University is a leading player in environmental research in China. During the past 5 years, the school has been involved in over 500 projects from National Water Pollution Control and Treatment Major Project, national 863 Program, national 973 Program, and National Science Foundation of China, totaling more than ￥500 million. Researchers in the school published >1000 SCI papers (150 in ES&T and other top journals) and obtained 285 national patents and 12 international patents. Over the past 10 years, the school received 6 honors from National Natural Science Awards, State Technological Invention Award, and National Science and Technology Progress Award, and more than 10 other awards from both national and local governments.

The School of the Environment consists of three departments: Department of Environmental Science, Department of Environmental Engineering, and Department of Environmental Planning and Management. It has established cooperation with many international universities, organizations and enterprises. The school has 12 English courses for undergraduate and graduate students, and offers several English short courses in summer. In 2015, collaborating with >10 top universities and research institutes, the school established the International Institute for Environmental Studies, further expanding its role in international stage.

Yixing Environmental Research Institute of Nanjing University

Introduction of Partnerships

Yixing Environmental Research Institute of Nanjing University is a research-oriented institute established by Nanjing University, Yixing municipal government and Yixing Industrial Park for Environmental Science & Technology. The objective of the institute is to provide a platform for innovative technology development, talent training and networking information communication.

In the past five years, the institute obtained three second prizes of State Natural Science Award and National Technology Invention Award, one prize for Scientific and Technological Innovation of Ho Leung Ho Lee Foundation, six first or second prizes at the provincial and ministerial-level. Over 20 invention patents and 10 software copyright were granted annually. The institute has undertaken several major scientific projects in the field of water pollution control and resource reuse, including national 863 projects, 973 projects, Sci-Tech supporting project, etc.

China Yixing Industrial Park for Environmental Science & Technology

China Yixing Industrial Park for Environmental Science & Technology (ES&TP) is the national Hi-Tech Industrial Development Zone which was approved by State Council in 1992, is also the unique National Hi-Tech Industrial Development Zone features developing environmental protection industry. Through the unique charm of landscape in south Yangzi and rich culture of environmental protection, ES&TP hasits unique brand influence. Five major areas of "Water, Gas, Sound, Solid, Instrument" go hand in hand, ES&TP continue to strengthen the cooperation with more than 20 countries and regions including the United States, Japan, Germany, Netherlands, Finland, Singapore, Hong Kong, Taiwan, etc., to form the close research cooperation with more than 80 colleges and universities such as HIT, NJU and Tsinghua, to establish the institute of environmental technology, R&D centers and industrial base. A modern industrial park which integrates R&D, manufacturing, engineering, construction, operations services take shape. The future ES&TP will be a business new town which has intensive headquarters economy, and active technical finance, a vitality new town which combines industry and town, integrates cultural and ecology, a capital of Chinese environmental industry which attacks global attention and has core competitiveness.

State Key Laboratory of pollution control and resource utilization

Located in the Yangtze River delta, the State Key Laboratory of Pollution Control and Resource Reuse is based on environmental science and engineering disciplines of Tongji University and Nanjing University, which covers 3 state key disciplines and 7 doctoral programs in environmental engineering, environmental science and municipal engineering.

The main research areas of the laboratory include: (1) Environmental behavior and ecological effects of pollutants；(2) Theory and technology of water pollution control；(3) Solid waste treatment and resource reuse； (4) Environmental remediation and watershed pollution control. Laboratory has 1 academician of Chinese Academy of Engineering, 36 professors, 28 associate professors. Over the past five years, the laboratory has won 6 national science and technology awards, including 1 National Natural Science Award, 2 National Technology Invention Awards, 2 National Science and Technology Progress Awards, 1 International Science and Technology Cooperation Award. 1278 papers were published in SCI journals, including 77 papers published in Environmental Science & Technology and 51 papers published in Water Research, of which 276 papers were published in journals with impact factor greater than 5. And, the published papers have been cited 15,388 times. The laboratory was awarded 421 patents, of which 15 were international patents and 72 were applied in practice.

10 Years Retrospect

JRCEEC WORKSHOPS

As part of its mission "to promote research collaboration, academic exchange, student education, and technology training and transfer," the China-US Joint Center holds annual workshops and periodic topical workshops. The links below provide additional information on the workshops held to date:

- 2015 Annual Workshop - "Critical Zone Science, Sustainability, and Services in a Changing World," Beck Agricultural Center (Purdue University) and the Holiday Inn Lafayette-City Center, West Lafayette, IN. U.S.A., October 22-24, 2015

-

10 Years Retrospect

- 2014 Annual Workshop - "Water, Energy, and Ecosystem Sustainable Development," Anhui Jinling Grand Hotel, Hefei, China, October 26-28, 2014

- 2013 Annual Workshop - "Environmental Health and Green Development," the Park Vista Hotel, Gatlinburg, Tennessee, USA, November 18-19, 2013

- China-US Joint Workshop on Biogeochemistry of Carbon and Nitrogen, Shenyang Agricultural University, China, June 27-28, 2013 (organized by JRCEEC's Collaborative Research Group of Biogeochemistry)
- US-China Workshop on Advances in Environmental Microbiology and Biotechnology, hosted by Nanjing University, Nanjing, China, May 31-June 1, 2013
- Special Forum - "Frontiers in Environmental Research," hosted by the Chinese Academy of Sciences' Institute for Soil Sciences, June 1, 2013
- Summer Workshop 2013-UT undergraduates and Haslam Scholars Kenna Rewcastle and Imani Chatman spent six weeks in Shenyang, China completing a soil science research project.

10 Years Retrospect

- Summer Workshop 2013 - Bioreporters and their applications for the detection of toxicity and endocrine disrupting chemicals in the environment, May 20-June 10, 2013.
- China-US Joint Workshop on Systems Biology for Environmental Sustainability, Shenyang, China, May 27-28, 2013
- Special Forum China - US Ecopartnership for Environmental Sustainability, Beijing, China, May 24, 2013
- 2012 Annual Workshop - "Land Use, Ecosystem Services, and Sustainable Development," Shenyang, China, September 17-19, 2012.

- 2011 Annual Workshop - "Global Sustainability Issues in Energy, Climate, Water, and Environment," Purdue University, West Lafayette, Indiana (USA), September 26-29, 2011.

10 Years Retrospect

- 2010 Annual Workshop - "Energy, Ecosystem, and Environmental Change," Beijing, China, September 22-24, 2010.

- 2010 Topical Workshop, No. 1 - "Sustainable Management of Soil and Water Resources, Shenyang, China, January 5-8, 2010
- 2010 Topical Workshop, No. 2 - "Biotechnology of Bioenergy Plants," Beijing, China, September 19-21, 2010.
- 2009 Topical Workshop - "Biotechnology of Bioenergy Plants," Knoxville, Tennessee, USA, November 16-17, 2009
- 2009 Annual Workshop - "The Climate-Energy Nexus," Oak Ridge, Tennessee, USA, November 11-13, 2009

10 Years Retrospect

- 2008 Annual Workshop - "Bioenergy Consequences for Global Environmental Change," Beijing, China, October 15-17, 2008

- 2007 Annual Workshop - "Environmental Aspects of Bioenergy Production and Sustainability," Knoxville, Tennessee, USA, September 11-13, 2007

Organizers and Committee

HOST

- Nanjing University, China

ORGANIZER

- State Key Laboratory of Pollution Control and Resources Reuse, China
- Environmental Research Institute of Nanjing University at Yixing
- China Yixing Industrial Park for Environmental Science & Technology
- School of Environment, Nanjing University
- China-US Joint Research Center for Ecosystem and Environmental Change

MAIN PARTICIPATING INSTITUTIONS

- The University of Tennessee
- Oak Ridge National Laboratory
- Purdue University
- Institute of Geographic Science and Natural Resources, Chinese Academy of Sciences
- Research Center for Eco-environmental Sciences, Chinese Academy of Sciences
- Institute of Applied Ecology, Chinese Academy of Sciences
- China Agricultural University
- Nanjing Agricultural University
- Tennessee Department of Environment and Conservation
- University of Science and Technology of China
- Zhejiang University
- Shanghai Jiaotong University
- Rice University
- University of Oklahoma
- University of Illinois at Urbana Champaign
- Michigan State University
- Texas A&M University
- University of Florida
- Vanderbilt University

SPONSORS

- U.S. National Science of Foundation
- China Scholarship Council
- National Natural Science Foundation of China
- Jiangsu Nanzi Environmental Protection, LTD

Organizers and Committee

PARTICIPANTS

The symposium invited approximately 80 recognizedscientists,20 program directors, and 100 industry leaders from the U.S. and China to give ~80 oral presentations, ~30 poster presentations, three roundtable discussions, and a number of field trips.

SCIENTIFIC COMMITTEE

Dr. Jun Chen (Nanjing University)

Vice Chairs:

Dr. Gui-Bin Jiang (Chinese Academy of Sciences)

Dr. Quan-Xing Zhang(Nanjing University)

Dr. Nan-Qi Ren (Harbin Institute of Technology)

Dr. Gary S. Sayler (The University of Tennessee)

Members:

Dr. Pedro Alvarez (Rice University)

Dr. Jun Bi (Nanjing University)

Dr. William Brown (University of Tennessee)

Dr. Timothy Filley (Purdue University)

Dr. Cheng Gu (Nanjing University)

Dr. Terry Hazen (University of Tennessee and ORNL)

Dr. Ted Henry (Heriot-Watt University and University of Tennessee)

Dr. Lan-Zhu Ji (Chinese Academy of Sciences)

Dr. Jennifer Jurado (Natural Resources Planning/Management Division, Broward County, Florida)

Dr. Frank Loeffler (University of Tennessee and ORNL)

Dr. Jiaguo Qi (Michigan State University)

Dr. Hong-Qiang Ren (Nanjing University)

Dr. John Stier (University of Tennessee)

Dr. Joseph Suflita (University of Oklahoma)

Dr. Warren Washington (National Center for Atmospheric Research, USA)

Dr. Gui-Rui Yu (Chinese Academy of Sciences)

Dr. Han-Qing Yu(University of Science and Technology of China)

Dr. Tong Zhang (The University of Hong Kong)

Dr. Xu-Dong Zhang (Chinese Academy of Sciences)

Dr. Fang-Jie Zhao (Nanjing Agricultural University)

Dr. Jinhua Zhao (Michigan State University)

ORGANIZING COMMITTEE

Chair:

Dr. Hong-Qiang Ren (Dean of School of the Environment, Nanjing University)

Members:

Dr. Xu-Xiang Zhang (Symposium Secretary-General, Nanjing University)

Dr. John Stier (Education Workshop Chair, The University of Tennessee)

Dr. Ren-Jie Dong (Education Workshop Chair, China Agricultural University)

Dr. Song Gao (Industry Workshop Chair, Yixing Environment Protection Industry Park)

Dr. Cheng Gu (Research Workshop Chair, Nanjing University)

Dr. Tim Filley (Research Workshop Chair, Purdue University)

Dr. Jie Zhuang (Symposium Coordinator, China-US Joint Research Center, CAS/UT)

Dr. Lin Ye (Symposium Secretary, Nanjing University)

Ms. Meiling Li (Symposium Coordinator, Chinese Academy of Sciences)

Dr. Kan Li (Symposium Secretary, Nanjing University)

REGISTRATION

No registration fee is charged on invited guests. The conference organizers will provide meals, hotels, and local transportation between the airport and hotel for the invited guests during the meeting period. 900 RMB registration fee will be charged for other participants and the registration feef or students is 600 RMB. Registration day is October 26 (Wednesday), meetings will be held on October 27-28, and field trips are arranged on October 29.

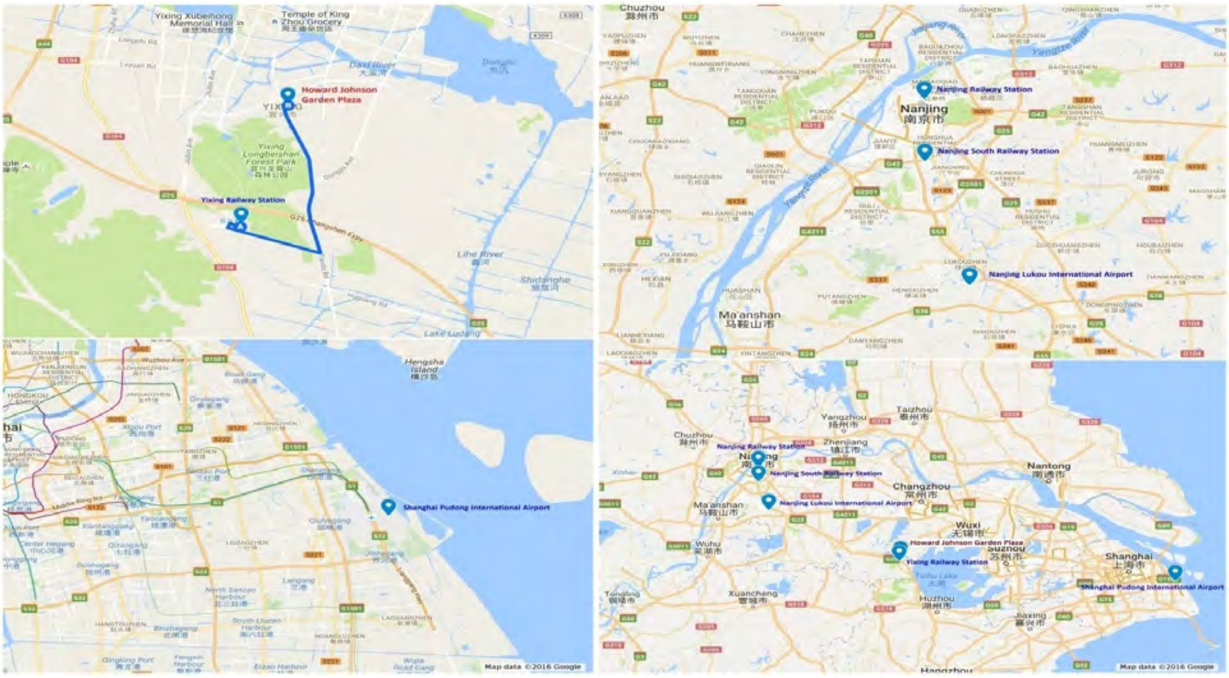
CONTACT INFORMATION

Dr. Kan Li
School of the Environment
Nanjing University
Nanjing, Jiangsu 230023, China
Phone: +86 (25) 89680363
Mobile: + 86 15951873428
Email: kan_li396@163.com

Venue

CONFERENCE VENUE

Participants will stay at the Howard Johnson Garden Plaza Hotel (five-star) located at No. 109 Taodu Road, Yixing, Jiangsu Province, China. Detailed hotel information is available via hotel telephone 400 0181 112 and webpage http://www.gardenplazayxhotel.com/home.html. The nearby airports and railway stations are shown in the following maps. The organizers will arrange transportation on Oct 26th and 29th, 30th.



Agenda

Overall Schedule

Time	Presentation	Location
October 26, 2016 (Wednesday)		
7:00-23:00	**Registration**	Lobby Hall
11:30-13:30	Lunch	
18:00-21:00	Buffet dinner	Cafeteria, 4th Floor
October 27, 2016 (Thursday)		
8:30-12:00	**Opening Ceremony and Keynote Forum**	Shenghui Great Hall, 3rd Floor
12:00-13:30	Lunch	Cafeteria, 4th Floor
13:30-18:00	Session 1: Biofuels and Water Treatment	Room Song-Qing, 3rd Floor
	Session 2: Agroecosystem Health and Human Impact	Room Tang-Yuan, 3rd Floor
	Session 3: Nexus of Human, Climate, and Ecosystem Functions	Room Han-Ming, 3rd Floor
	Workshop for China-US Doctoral Environment & Energy Program (DEEP)	Room Sheng-Hao, 3rd Floor
17:30-20:00	Banquet and Cultural Performance	Shenghui Hall 3rd Floor
All Day	Poster Display	3rd Floor
October 28, 2016 (Friday)		
8:30-12:00	Session 4: Environmental Process and Remediation	Room Song-Qing, 3rd Floor
	Session5: Resources Transformation for Energy and Environment	Room Tang-Yuan, 3rd Floor
	Workshop for Outstanding Young Researchers in Environment & Energy	Room Han-Ming, 3rd Floor
12:00-13:00	Lunch	Cafeteria, 4th Floor
13:00-17:50	Session 6: Nexus of Food, Energy, water and Soil **Closing Ceremony and Keynote Forum**	Shenghui Great Hall, 3rd Floor
18:00-20:00	Banquet	Room Sheng-Hao 3rd Floor
October 29, 2016 (Saturday)		
8:30-18:00	**Departure and Post-Conference Activity**	Yixing ES&T Park

Agenda

Wednesday, October 26, 2016

Arrival and Evening Reception

(Howard Johnson Garden Plaza, Yixing, Jiangsu Province)

Thursday Morning, October 27, 2016

7:00-8:30	**Breakfast in Hotel Restaurant**
8:30-9:15	**Welcome and Opening Speeches** Place: Shenghui Great Hall Chair: Jun Bi, Nanjing University Welcome by leader ofNanjing University Partnership Introduction and Review by Gary Sayler, University of Tennessee Remarks by William Brown, University of Tennessee Remarks by leader of China Scholarship Council Remarks by leader of U.S. National Science Foundation Welcome by leader of Yixing Municipal Government Introduction of Yixing Industrial Park for Environmental Science & Technology
9:15-9:45	**Group Photo and Tea Break**
9:45-12:00	**Opening Keynotes** Chairs: Terry Hazen, University of Tennessee & Oak Ridge National Laboratory Cheng Gu, Nanjing University
9:45-10:30	**Climate Modeling Is Becoming Ecosystem Modeling: Its History and Prediction of Future Environmental Change** Warren Washington, National Center for Atmospheric Research, USA
10:30-11:15	**Perspective of Fermentative H_2 Production from Biomass for Commercialization** Nanqi Ren, Harbin Institute of Technology, China
11:15-12:00	**Nanotechnology – Enabled Water Treatment: A Vision to Enable Decentralized Water Treatment** Pedro Alvarez, Rice University, USA
12:00-13:00	**Lunch – Hotel Restaurant**

Thursday Afternoon, October 27, 2016

13:30-17:55	**Session 1: Biofuels and Water Treatment** Place: Room Song-Qing Chairs: Mark Nanny, University of Oklahoma Jie Bao, East University of Science and Technology
13:30-13:35	Chairs' Introduction
13:35-14:15	**Keynote: Microbial Enhanced Energy Recovery (MEER): Chemistry and Biology for the Conversion of Fossil Carbon to Methane** Mark Nanny, University of Oklahoma
14:15-14:55	**Keynote: Augmented Treatment of Refractory Wastewater: Acidogenesis As a Core Process** Aijie Wang, Research Center for Eco-environmental Sciences, CAS
14:55-15:35	**Keynote: Maximizing Cellulosic Ethanol Potentials by Minimizing Energy Input and Waste Water Generation in Lignocellulose Biorefining** Jie Bao, East University of Science and Technology
15:35-16:15	**Keynote: Fuel Stability and Biocorrosion: The Impact of Environmentally Green Initiatives** Joseph Suflita, University of Oklahoma
16:15-16:35	**Development of Advanced Materials and Technologies for Efficient Treatment of Emulsified Oily Wastewater** Hongting Zhao, Hangzhou Dianzi University of Science and Technology
16:35-16:55	**Biocatalyst Development for Economic Advance Biofuel Production at Omics Era** Shihui Yang, Hubei University& U.S. National Renewable Energy Laboratory
16:55-17:15	**Research Towards Engineering Water-Use Efficiency of CAM Plants to C3 and C4 Plants** Zong-Ming Cheng, University of Tennessee
17:15-17:35	**Faster, Farther, Easier, More — the Promises of the Coming Mobility Revolution** Lee Han, University of Tennessee
17:35-17:55	**Application Potential of Acetylacetone in Water Treatment** Shujuan Zhang, Nanjing University
18:00-19:30	**Banquet**

Agenda

Thursday Afternoon, October 27, 2016

13:30-17:55	**Session 2: Agroecosystem Health and Human Impact** Place: Room Tang-Yuan Chairs: Hui Li, Michigan State University Jennifer DeBruyn, University of Tennessee
13:30-13:35	Chairs' Introduction
13:35-14:15	**Keynote: Soil Drought and Water Carrying Capacity for Vegetation in the Critical Zone of the Loess Plateau** Mingan Shao, Institute of Geographic Science& Natural Resources Res., CAS
14:15-14:55	**Keynote: Minimizing Eutrophication: Maximizing N and P Uptake of Plants** Guohua Xu, Nanjing Agricultural University
14:55-15:35	**Keynote: Uptake of Pharmaceutical Chemicals by Vegetable Crops from Water and Soil** Hui Li, Michigan State University
15:35-15:55	**Biodegradable Plastic Agricultural Mulches: Microbial Degradation and Impacts on Soil Ecology** Jennifer DeBruyn, University of Tennessee
15:55-16:15	**Subsurface Lateral Flow and Nitrogen Loading in Agricultural Catchment of Subtropical China** Bin Zhang, Chinese Academy of Agricultural Sciences
16:15-16:35	**Tall Fescue (*Festuca Arundinacea*) Yield and Trace Metals and Organics Uptake at High Soil Amendments Rates of a Class B Municipal Biosolids** Shawn Hawkins, University of Tennessee
16:35-16:55	**Seasonal Climate Variation Impacts on Soil Microbial Community in Forest Ecosystems** Gengxin Zhang, Institute of Tibetan Plateau Research, CAS
16:55-17:15	**Toxicant Fate and Bioavailability during Sorption-desorption Interactions with Particles (Engineered Nanoparticles and Plastics) in the Aqueous Phase** Ted Henry, Heriot-Watt University& University of Tennessee
17:15-17:35	**The Dual Effects of Selenium at Environmentally Realistic Concentrations in Aquatic Organisms** Lingtian Xie, Institute of Applied Ecology, CAS
17:35-17:55	**Understanding the Environmental Link to Obesity: The Story of Parabens** Ling Zhao, University of Tennessee
18:00-19:30	**Banquet**

Thursday Afternoon, October 27, 2016

13:30-17:55	**Session 3: Nexus of Human, Climate, and Ecosystem Functions** Place: Room Han-Ming Chairs: Liding Chen, Chinese Academy of Sciences Brian Leib, University of Tennessee
13:30-13:35	Chairs' Introduction
13:35-14:15	**Keynote: Arsenic Biogeochemistry and Impacts on Rice Production and Quality** Fangjie Zhao, Nanjing Agricultural University
14:15-14:55	**Keynote: Antibiotics and Resistant Genes in the Environment as Emerging Pollutants** Tong Zhang, The University of Hong Kong
14:55-15:35	**Keynote: Vadose Zone Processes that Control the Transport ofColloids and Colloid-Associated Contaminants to Groundwater** Scott Bradford, U.S. Salinity Laboratory, U.S. Department of Agriculture
15:35-15:55	**Bio-Manufacturing value-added chemicals from renewable substrates** Yu Deng, Jiangnan University
15:55-16:15	**China's Energy-Water Nexus: Spillover Effects of Energy and Water Policy** Yuanchun Zhou, Nanjing University
16:15-16:35	**The Production of Hydrated Electrons and Degradation of Organic Contaminants Catalyzed by Clay Minerals** Cheng Gu, Nanjing University
16:35-16:55	**Outcome Pathway: A Role of Environmental "-Omics" in Environmental Science** Xiaowei Zhang, Nanjing University
16:55-17:15	**Assessment on Hydro-Ecosystem Health in Haihe River Basin** Liding Chen, Research Center for Eco-environmental Sciences, CAS
17:15-17:35	**Improving Row Crop Production on Sandy Soils through Precision-Deficit Irrigation and Increased Water Retention Resulting in Greater Energy Efficiency and Less Potential for Water Quality Degradation** Brian Leib, University of Tennessee
17:35-17:55	**Bioavailability of POPs: Method Development for Physiologically Based *in vitro* Extractions** Xinyi Cui, Nanjing University
18:00-19:30	**Banquet**

Agenda

Thursday Afternoon, October 27, 2016

13:30-17:30	**Workshop for China-US Doctoral Environment & Energy Program(DEEP)** Place: Room Shenghao Chairs: John Stier, University of Tennessee Renjie Dong, China Agricultural University
13:30-13:35	Chairs' Introduction
13:35-13:45	Opening Speech by Leader of China Scholarship Council
13:45-14:05	**Introduction of the DEEP Program** Renjie Dong, China Agricultural University
14:05-14:25	**Program Progress and Prospect** John Stier, University of Tennessee
14:25-14:50	**Keynote: How to Become an Outstanding Scientist** Terry Hazen, University of Tennessee& Oak Ridge National Laboratory
14:50-15:15	**Keynote: Experience in Training Student Researchers** Xudong Zhang, Institute of Applied Ecology, Chinese Academy of Sciences
15:15-15:40	**Keynote: Publications: The Currency of Science** Frank Loeffler, University of Tennessee& Oak Ridge National Laboratory
15:40-16:00	**Try the Best to Assist Student to Be a Better Young Scholar** Yufang Song, Institute of Applied Ecology, CAS
16:00-16:20	**Bridging Research via DEEP** Qiang He, University of Tennessee
16:20-16:40	**Developments and Initiatives in the Course of Internationalization** Jie Hu, Nanjing University
16:40-16:55	**Study, Research, and Life at the University of Tennessee** Lidong Li, MS Degree from Institute of Applied Ecology, CAS
16:55-17:10	**Predicting Habitat of Kudzu Bug (*Megacoptacribraria*) in the United States and Use of Remote Sensing to Detect Impacts of Kudzu Bug on Kudzu** Wanwan Liang, MS Degree from China Agricultural University
17:10-17:40	**Panel Discussion on Program Improvement**
17:40-17:50	**Closing Remarks**
18:00-19:30	**Banquet**

Friday Morning, October 28, 2016

8:30-11:55	**Session 4: Environmental Process and Remediation** Place: Room Song-Ning Chairs: Yuji Arai, University of Illinois at Urbana Champaign Xinde Cao, Shanghai Jiaotong University
8:30-8:35	Chairs' Introduction
8:35-9:15	**Keynote: New Ecological Technologies on Treatment of Organic and Phosphate/Nitrogen Polluted Water System** Jinshui Wu, Institute of Subtropical Agro-ecosystem, CAS
9:15-9:55	**Keynote: Site Remediation: An Adaptive Process** Andy Binford, Tennessee Department of Environment and Conservation
9:55-10:15	**Amendment-induced Immobilization of Heavy Metals in Contaminated Soils: Mechanisms and Applications** Xinde Cao, Shanghai Jiaotong University
10:15-10:35	**Environmental Chemistry of As/Sb in Soil-Plant System** Yujun Wang, Institute of Soil Science, CAS
10:35-10:55	**Remediation of Contaminated Soil and Groundwater: from Lab to Field** Hongyan Guo, Nanjing University
10:55-11:15	**Reaction Condition Effects on Re(VII) Sorption Kinetics at the Zero Valent Iron-Water Interface** Yuji Arai, University of Illinois at Urbana Champaign
11:15-11:35	**The Toxic Effects of Deltamethrin and Fenvalerante in Soil Identified by a Multi-Endpoint Study Using Earthworm (*EiseniaFetida*) as the Test Species** Yufang Song, Institute of Applied Ecology, CAS
11:35-11:55	**Elucidating Metal Sorption Mechanisms at the Soil Mineral/Water Interface Using Novel Synchrotron Techniques** Wei Li, Nanjing University
12:00-13:00	**Lunch – Hotel Restaurant**

Agenda

Friday Morning, October 28, 2016

8:30-11:55	**Session 5: Resources Transformation for Energy and Environment** Place: Room Tang-Yuan Chairs: Ernest Blatchley, Purdue University Renjie Dong, China Agricultural University
8:30-8:35	Chairs' Introduction
8:35-9:15	**Keynote: Process Theory and Applications of Photochemical Reactors** Ernest Blatchley, Purdue University
9:15-9:55	**Keynote: Development of Anaerobic Digestion of Organic Wastes** Renjie Dong, China Agricultural University
9:55-10:15	**Microbial Interactions in Anaerobic Treatment Processes** Qiang He, University of Tennessee
10:15-10:35	**Biochar Technology in the Nexus of Food, Energy, Water, and Soil Systems** Wei Zhang, Michigan State University
10:35-10:55	**Agricultural Adaptation to Climate Change: The Role of Technologies and Institutions** Jinhua Zhao, Michigan State University
10:55-11:15	**Metabolic Engineering of *Klebsiella Pneumoniae* for Chemicals Production** Jian Hao, Shanghai Advanced Research Institute, CAS
11:15-11:35	**Development of Bio-based Materials for Environmental Remediation** Siqun Wang, University of Tennessee
11:35-11:55	**Catalytic Hydrogenation Reduction of Pollutants in Water** Shourong Zheng, Nanjing University
12:00-13:00	**Lunch – Hotel Restaurant**

Friday Morning, October 28, 2016

8:30-11:40	**Workshop for Outstanding Young Researchers in Environment& Energy** Place: Room Hang-Ming Chairs: Jun Yan, University of Tennessee Sindhu Jagadamma, University of Tennessee
8:30-8:35	Chairs' Introduction
8:35-8:55	**Keynote: Corrinoid Controlled Reductive Dechlorination Activity in Organohalide-Respiring Dehalococcoidesmccartyi** Yan Jun, University of Tennessee
8:55-9:15	**Keynote: Soil Organic Matter Sequestration and Cycling in Managed Ecosystems** Sindhu Jagadamma, University of Tennessee
9:15-9:35	**Keynote: Spatial and Seasonal Patterns in Bacterioplankton Communities across Environmental Gradients from a River to Lake** Zhonghua Tong, University of Science and Technology of China
9:35-9:55	**Keynote: Effect of Organic Matter on the Retention and Transport of PPCPs in Agricultural Soils: A Surface-Pore Integrated Mechanism** Xijuan Chen, Institute of Applied Ecology, CAS
9:55-10:15	**Keynote: Bioassay-directed Identification of Specific Toxicants in Waste Water from Industrial Parks** Wei Shi, Nanjing University
10:15-10:35	**Keynote: Cultivation of Aerobic Granular Sludge in Continuous-Flow Reactors** Lin Ye, Nanjing University
10:35-10:50	**Fungal Leaching of Heavy Metals from Contaminated Dredged Sediments** Xiangfeng Zeng, Institute of Applied Ecology, CAS
10:50-11:05	**Maternal Transfer and Reproductive Effects of Cr(VI) in Japanese Medaka (Oryziaslatipes) under Acute and Chronic Exposures** Hongxing Chen, Institute of Applied Ecology, CAS
11:05-11:20	**Evolvement of Dimension and Resolution of Element Availability Evaluation Based on a Passive Sampling Technique** Dongxing Guan, Nanjing University
11:20-11:35	**Life Cycle Performance of Biofuels from Microalgae: The GHG Emissions, Energy, Water, Land and Co-products** Yizheng Zhang, University of California, Davis
11:35-11:50	**Liver Proteomics Change of Male and Female Mice After Perfluorohexanesulfate Administration and the Influence of Vehicle** Kan Li, Nanjing University
12:00-13:00	**Lunch – Hotel Restaurant**

Agenda

Friday Afternoon, October 28, 2016

13:30-17:20	**Session 6: Nexus of Food, Energy, Water and Soil** Place: Shenghui Great Hall (all sessions together) Chairs: Gary Sayler, University of Tennessee Jennifer Jurado, Broward County, Florida, USA
13:30-13:35	Chairs' Introduction
13:35-14:10	**Keynote: Environmental Systems Approaches to Bioremediation of Contaminated Sites** Terry Hazen, University of Tennessee& Oak Ridge National Laboratory
14:10-14:45	**Keynote: From Biomass to Biochar: An Emerging Green Technology** Genxing Pan, Nanjing Agricultural University
14:45-15:20	**Keynote: Nitrogen Cycling out of Control: The Need to Renew the Nitrogen Economy** Frank Loeffler, University of Tennessee & Oak Ridge National Laboratory
15:20-15:55	**Keynote: China's Energy-Water Nexus: Spillover Effects of Energy and Water Policy** Jun Bi, Nanjing University
15:55-16:30	**Keynote: NSF INFEWS Project and the CGCEO Involvement in Future Earth, Particularly FE in Asia in the Area of FEW Nexus** Jiaguo Qi, Michigan State University
16:30-17:05	**Keynote: Building Community Resilience through Integrated Natural Resource and Urban Planning in Broward County, Florida, USA** JenniferJurado, Broward County, Florida, USA
17:05-17:35	**Group Discussion on INFEWs**
17:35-17:45	**Conference Summary ---** Gary Sayler, The University of Tennessee
17:45-17:50	**Closing Remarks ---** Jun Bi, Nanjing University
18:00-19:30	**Conference Ends and Dinner at Hotel**

Saturday, October 29, 2016

Departure and Post-Conference Activity

2016 China-US Joint Symposium

International Nexus of Food, Energy, Water, and Soil

ABSTRACT

Climate Modeling is Becoming Ecosystem Modeling: Its History and Prediction of Future Environmental Change

Warren M. Washington

National Center for Atmospheric Research Boulder, Colorado, USA

Climate modeling has developed like other areas of science and over the last fifty years to become a very useful tool for research and prediction of future changes in our global environment. The most recent Intergovernmental Panel on Climate Change Assessment Report (IPCC assessment) has convinced most climate scientists that humankind is changing the earth's climate and ecosystem. Also it has led to significant global warming which is already taking place.

Some scientists are skeptical of the IPCC view and think the observed changes result from natural climate variability or other causes. A brief review of recently observed 20th century climate change will be presented and compared with climate and Earth system model simulations. These computer simulations are extended into the 21st century and beyond in preparation for the next IPCC assessment. A brief description of the modeling system history and what is in climate models will be given with an emphasis on the physical, chemical, and biological aspects. Computer simulations and animations of present climate and future environmental change will be shown using low and high carbon emission scenarios.

Finally, at the end there will be a discussion of the scientific uncertainties and societal impacts along with an analysis of policy options including possible geoengineering of the climate system. The issue of environmental justice will also be addressed.

Biographical information:
http://www.cgd.ucar.edu/staff/wmw/medal-of-science.html
http://www.cgd.ucar.edu/ccr/warren/

Abstract

Nanotechnology-Enabled Water Treatment: A Vision to Enable Decentralized Water Treatment

Pedro J.J. Alvarez

Department of Civil & Environmental Engineering, Rice University, Houston, TX 77005, USA

Through control over material size, morphology and chemical structure, nanotechnology offers novel materials that are nearly "all surface" and that can be more reactive per atom than bulk materials. Such engineered nanomaterials (ENMs) can offer superior catalytic, adsorptive, optical, electrical and/or antimicrobial properties that enable new technology platforms for next-generation water treatment. This presentation will address emerging opportunities for nanotechnology to meet a growing need for safer and more efficient decentralized water treatment and reuse. Because water is by far the largest waste stream of the energy industry, emphasis will be placed on technological innovation to enable produced water reuse in remote (off-grid) oil and gas fields or offshore platforms, to minimize freshwater withdrawals and disposal challenges. Examples of applicable nano-enabled technologies include fouling-resistant membranes with embedded ENMs that allow for self-cleaning and repair; capacitive deionization with highly conductive and selective electrodes to remove multivalent ions that precipitate or cause scaling; rapid magnetic separation using superparamagnetic nanoparticles; solar-thermal processes enabled by nanophotonics to desalinate with membrane distillation; disinfection and advanced oxidation using nanocatalysts; and nanostructured surfaces that discourage microbial adhesion and protect infrastructure against biofouling and corrosion. These enabling technologies can be used to develop compact modular water treatment systems that are easy to deploy and that can treat challenging waters to protect human lives and support sustainable economic development.

Short Bio: Pedro J.J. Alvarez is the George R. Brown Professor of Civil and Environmental Engineering at Rice University, where he also serves as Director of the NSF ERC on Nanotechnology-Enabled Water Treatment (NEWT). His research interests include environmental implications and applications of nanotechnology, bioremediation, fate and transport of toxic chemicals, water footprint of biofuels, water treatment and reuse, and antibiotic resistance control. Pedro received the B. Eng. Degree in Civil Engineering from McGill University and MS and Ph.D. degrees in Environmental Engineering from the University of Michigan. He is the 2012 Clarke Prize laureate and also won the 2014 AAEES Grand Prize for Excellence in Environmental Engineering and Science. Past honors include President of AEESP, the AEESP Frontiers in Research Award, the WEF McKee Medal for Groundwater Protection, the SERDP cleanup project of the year award, and various best paper awards

Abstract

with his students. Pedro currently serves on the advisory board of NSF Engineering Directorate and as Associate Editor of Environmental Science and Technology. He also serves on the Advisory Board of the Engineering Director of the National Science Foundation (NSF).

Abstract

Site Remediation: An Adaptive Process

Andy Binford

Division of Remediation, Tennessee Department of Environment and Conservation, Nashville, TN 37243, USA

Site Remediation, An Adaptive Process: No crystal ball exists to show how to achieve site remediation. Uncertainty has to be managed, and approaches may change as more is learned about the site. Adaptive remediation may utilize existing and emerging site conditions to address surface water, sediment, groundwater, and soil contamination and to protect human health and the environment. The discussion will focus on Tennessee's Copper Basin mining district and recovery of the Ocoee River to demonstrate an adaptive remediation process incorporating existing infrastructure in remedial treatment systems, contingency planning to minimize unintended consequences, and taking advantage of natural processes. The discussion will also incorporate discussion from other sites that show how an adaptive approach was applied to minimize future mercury releases to surface water during site cleanup, to refocus cleanup of carbon tetrachloride and RDX from groundwater, and to alter soil remediation to prevent adverse consequences.

Abstract

Building community resilience through integrated natural resource and urban planning in Broward County, FL

Jennifer L. Jurado

Environmental Planning and Community Resilience Division, Broward County, Florida, USA

Broward County is a densely urbanized coastal community located in peninsular southeast Florida with an economy and quality of life tightly connected to diverse natural resources. Environmental protections and resource sustainability are prominent in the County's resiliency planning, with programs organized to meet these needs through sustainable practices that include regionally-coordinated water resources management, energy conservation programs, climate risk and vulnerability assessments, urban lands enhancements, shoreline protection, and marine resource conservation. For these, and additional efforts, Broward County was the first county in the United States to earn a 4-STAR rating through ICLEI's sustainable communities program.

As part of climate resiliency planning, the County has adopted a community-wide Climate Action Plan with 110 actionable goals addressing policy, natural resources, energy, water, the built environment, and community. Prominent efforts include a renewable energy action plan, diverse green initiatives, and innovative financing to facilitate energy and resiliency improvements in residential and commercial structures. An integrated water resources plan emphasizes regional water conservation, improved stormwater management, and alternative water supply projects. Land use planning promotes the preservation and enhancement of natural areas and open spaces, with recent updates to address future climate conditions, sea level rise, the establishment of adaptation action areas, and mechanisms to achieve greater water storage and flood protection in the urban environment.

Broward's beaches are not only vital to the economy, also protect coastal infrastructure and property from storm damage while providing essential habitat for nesting sea turtles. After a history of managing large-scale beach nourishment projects fueled by offshore sand sources, the County is transitioning to higher quality inland sand sources, smaller but more frequent projects, and living shorelines as enhanced resiliency measures. Coral reef conservation and enhancement activities are being expanded to include increased mitigation for impacts, coral nurseries to cultivate colonies for transplant, elimination of ocean outfalls, and tighter controls on coastal construction. Such efforts are increasingly important as part of long-term management strategies as rising temperatures and disease compound stresses on an already fragile system.

Broward County's integrated natural resource planning and management activities are designed to reduce urban pressures on the natural environment, while diversifying investments in conservation strategies and sustainable resource development. The

Abstract

County's policy and planning efforts are reinforced through strong environmental regulations, including strict numeric water quality standards and prohibitions against new non-domestic discharges to surface waters, augmented with comprehensive monitoring programs. Climate change pressures have reinforced the need for progressive environmental programs and resilience strategies that effectively integrate urban and natural system needs, an approach necessary for the viability of both community and the economy.

Abstract

Bio-Manufacturing value-added chemicals from renewable substrates

Yu Deng
National Engineering Laboratory for Cereal Fermentation Technology, Jiangnan University
Wuxi, Jiangsu, China, 214122
Email: dengyu@jiangnan.edu.cn

The fine chemicals are very important to human society and they are typically produced by chemical reactions. However, the chemical reactions have a lot issues such as heavy pollution and green gas, etc. With the fast development of biotechnology, more and more fine chemicals are able to be produced by fermentation. Our research focused on the microorganisms such as Thermobifida fusca and E. coli, etc to produce butyric acid, malic acid, adipic acid, etc at high titer and productivity from renewable substrates with the help of systems biology, metabolic engineering and synthetic biology.

Abstract

Effects of pyrogenous organic matter on bacterial community structure and biogeochemical cycling genes in nutrient-sufficient and nutrient-deficient soils

Zhongmin Dai, Jianming Xu*

Institute of Soil and Water Resources and Environmental Science,
Zhejiang Provincial Key Laboratory of Agricultural
Resourcesand Environment, Zhejiang University, Hangzhou 310058, China

* Corresponding author Tel. & Fax. +86-571-8898-2069; E-mail: jmxu@zju.edu.cn

Pyrogenous organic matter (PyOM) can improve the microbial environment and therefore affect the soil biogeochemical cycling processes mediated by microbes. In this study, PyOMs pyrolyzed from swine manure, produced at pyrolysis temperatures of 300 ˚C and 700 ˚C respectively, were added to two different nutrient status soils for incubation. High Throughput Sequencing was applied to investigate the effects of PyOM on soil bacterial community structure and the genes responsible for biogeochemical cycling. The PyOMs significantly altered the soil microbial diversity in a Psammaquent soil, but had no significant effects in an Argiustoll soil. In addition, PyOMs significantly increased the relative abundances of Actinobacteria, Acidobacteria and Alphaproteobacteria, and decreased the Chloroflexi and Firmutes populations in aPsammaquent soil, while the changes in the Argiustoll soil were much smaller. At the gene level, the PyOMs increased the abundance of the genes coding for nitrification (nitrite to nitrate) and denitrification (NO to N2O), and the increases following PyOM 300˚C addition were higher than with PyOM 700˚C. Overall, the aliphatic C-dominated PyOM had greater effects on the total bacterial community structure than the aromatic-dominated PyOM. Also, the beneficial effects of PyOMs added to the nutrient-deficient soil were larger than in the nutrient-sufficient soil.

Keywords Pyrogenous organic matter, microbial communities, functional genes, soil types, aromatic C

Abstract

Soil drought and water carrying capacity for vegetation in the critical zone of the Loess Plateau

Ming'an Shao[1,2]*, Yuanqiang Wang[3], Yongqiu Xia[4], Xiaoxu Jia[1]

[1]*Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China*
[2]*State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Yangling 712100, China*
[3]*State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an, Shaanxi 710061, China*
[4]*State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, China*

Corresponding author e-mail: shaoma@igsnrr.ac.cn

A dried soil layer (DSL) formed in the soil profile is a typical indicator of soil drought caused by climate change and/orin proper land management (such as the introduction of exotic plant species and high density planting). The occurrence of DSL can change the water flow in soil-plant-atmosphere continuum (SPAC) by preventing water exchanges between upper soil layers and groundwater. Consequently, a DSL may limit the sustainability of environmental restoration on the Loess Plateau of China and in other similar arid and semiarid regions in the world. Studies on the formation of a DSL and its effects on eco-environment are therefore important issues of soil science as well as ecology. This presentation proposed the discovery and definition of DSL, the evaluation indices for characterizing DSL (i.e., DSL thickness, DSL forming depth and mean soil water content with the DSL), the formation processes of DSL, and its spatial variations across the Plateau. In order to control or reclaim DSL, we provide a new model (i.e., soil water carrying capacity for vegetation model, SWCCV) for understanding soil-vegetation interactions and making recommendations for better management of vegetation construction on the Plateau. The components and processes of the SWCCV model will be proposed in this presentation. Also we will give specific applications performed in the Liudaogou catchment in the northern Plateau to show the modeling results for three vegetation types. Using SWCCV model to assess the consumption process of soil water with vegetation growth, optimal plant density or biomass can be established to make better recommendations for the construction of vegetation in the Plateau.

Abstract

China's energy-water nexus: Spillover effects of energy and water policy

Yuanchun Zhou[1,2], Huipeng Li[1], Ke Wang[3], Jun Bi[1,2]*

[1]State Key Laboratory of Pollution Control and Resource Reuse, School of Environment, Nanjing University, Nanjing 210023, China
[2]School of Government, Nanjing University, Nanjing 210023, China
[3]School of Environment & Natural Resources, Renmin University of China, Beijing 100872, China

Corresponding author e-mail: jbi@nju.edu.cn

The nexus between water and energy is drawing increasing attention in China. The large water requirements for energy production are driving us to consider the spillover effects that energy and water policies are having on both resources. The present study builds a multi-sectoral dynamic computable general equilibrium (CGE) model with an energy tax module to study the impact on energy and water resources. Based on the proposed model, different policy designs with different ad valorem tax rates are simulated. The results show that energy production and demand would be negatively affected by the reform in terms of output shrinkage in most sectors and that the effect will be larger with a higher tax rate. The energy structure would be improved, with sharp decreases in fossil fuel production and demand, whereas cleaner forms of energy would increase. The water resources required for energy production would be significantly decreased based on the energy effect of the energy tax, which would also contribute greatly to the achievement of the 3 Redlines goals of water conservation. Water conservation policy decreases the amount water used by thermal power plants, but increases energy consumption. Hence, site-specific factors should be considered when determining the sustainable management of water and energy in different regions of China.

Abstract

Spatial and seasonal patterns in bacterioplankton communities across environmental gradients from a river to lake

Yan-Shan Wang, Zhong-Hua Tong*, Han-Qing Yu

CAS Key Laboratory of Urban Pollutant Conversion, Department of Chemistry, University of Science & Technology of China, Hefei, 230026, China

Corresponding author e-mail: zhtong@ustc.edu.cn

Bacterioplankton plays critical roles in biogeochemical cycling and previous studies of bacterioplankton communities mainly focus on thespatial and temporal variation within individual habitat. Yet few studies are involved in their change through both different habitats and multiple seasons. In this work, we usedhigh-throughput sequencing technique to investigate the seasonal and spatial variability of bacterioplankton community composition of two habitats (Nanfei River and Chaohu Lake) with obvious environmental gradients. Principal Co-ordinates Analysis(PCoA) of unweighted UniFrac distance shows that the bacterioplankton communities could be separated into three groups (MRPP and ANOSIM, $P<0.05$): R, WS and SA, representing samples from Nanfei River, winter-spring and summer-autumn samples from Chaohu Lake, respectively. Our results showed seasonal variation of bacterioplankton community in Chaohu Lake and spatial difference between Nanfei River and Chaohu Lake. Environmental parameters associated with bacterioplankton community composition difference were identified by redundancy analysis (RDA). Variance partitioning RDA further suggested the combined effects of all variables may be the most important factors affecting taxonomic composition. This study provides a framework for modeling the change in bacterioplankton communities through a river to lake gradient.

Abstract

Corrinoid Controlled Reductive Dechlorination Activity in Organohalide-Respiring *Dehalococcoidesmccartyi*

Jun Yan[1,2,3,4,5] and Frank E. Löffler[2,3,4,5]

[1]*Key Laboratory of Pollution Ecology and Environmental Engineering, Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, Liaoning 110016, China*
[2]*Department of Microbiology and*[3]*Center for Environmental Biotechnology, University of Tennessee, Knoxville, Tennessee 37996, USA*
[4]*Biosciences Division and*[5]*Joint Institute for Biological Sciences (JIBS), Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA*

Corrinoid auxotrophic organohalide-respiring *Dehalococcoidesmccartyi*(*Dhc*) strains are keystone bacteria for reductive dechlorination of toxic and carcinogenic chloroorganic contaminants. We demonstrate that the lower base attached to the essential corrinoid cofactor of reductive dehalogenase (RDase) enzyme systems affects dechlorination rates and extents. Amendment of 5',6'-dimethylbenzimidazolyl-cobamide (DMB-Cba) to *Dhc* strain BAV1 and strain GT cultures supported *cis*-1,2-dichloroethene-to-ethene reductive dechlorination at rates of 107.0 (± 12.0)and 67.4 (± 1.4) µM Cl^- released day^{-1}, respectively. Strain BAV1, expressing the BvcARDase, reductively dechlorinated VC to ethene, albeit at up to 5-fold lower ratesin cultures amended with cobamides carrying 5'-methylbenzimidazole (MeBen), 5'-methoxybenzimidazole (MeOBen), or benzimidazole (Ben) as the lower base. In contrast, strain GT harboring the VcrARDase failed to grow and dechlorinate VC to ethene in medium amended with MeOBen-Cba or Ben-Cba. The amendment with DMB to inactive strain GT cultures restored the VC-to-ethene-dechlorinating phenotype and intracellular DMB-Cba was produced, demonstrating cobamide remodeling. The observed *Dhc* strain-specific responses to cobamides implicate that the lower base controls *Dhc* reductive dechlorination rates and extents (i.e., detoxification), and therefore the dynamics of *Dhc* strains with distinct RDase genes. These findings emphasize that the role of the corrinoid/lower base synthesizing community must be understood to predict strain-specific *Dhc* activity and achieve efficacious contaminated site cleanup.

Abstract

Nitrogen Cycling out of Control: The Need to Renew the Nitrogen Economy

Frank Löffler

Center for Environmental Biotechnology, Department of Microbiology, Department of Civil & Environmental Engineering, The University of Tennessee, Knoxville, TN 37996, USA
Biosciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA

The invention by Haber and Bosch to produce ammonium fertilizer from nitrogen and hydrogen revolutionized agricultural production and enabled the human population to reach 7 billion. The Haber-Bosch process introduces about 100 Tg of reactive N per year into the environment worldwide as fertilizer, and the N cycle has been more perturbed than any other basic element cycle. The unprecedented fertilizer input has major environmental consequences including elevated nitrate concentrations in groundwater water and increased emissions of nitrous oxide (N_2O), a potent greenhouse gas with ozone destruction potential. The turnover of nitrogenous compounds in terrestrial and aqueous environments is almost entirely controlled by microbes, and their activities determine N_2O fluxes. While a variety of processes contribute to N_2O formation, the only known N_2O consumption reaction involves microbial N_2O reductase (NosZ). The canonical clade I-type N_2O reductase of denitrifiers has been studied in detail but the recent discovery of clade II N_2O reductases substantially expanded the diversity of this enzyme system. Metagenomic surveys demonstrated that the clade IIN_2O reductase genes outnumber their clade I counterparts in the majority of soils. Growth experiments with organisms harboring the different types of N_2O reductase genes demonstrated that bacteria expressing clade II NosZ have significantly higher affinities to N_2O suggesting they control N_2O emissions to the atmosphere. This example demonstrates the need for detailed understanding of the microbiology involved in the turnover of nitrogenous compounds. In concert with technological advances in fertilizer production and application, control over relevant microbial processes promises to reduce the impact of agriculture on groundwater quality and greenhouse gas emissions.

Abstract

Vadose Zone Processes that Control the Transport of Colloids and Colloid-Associated Contaminants to Groundwater

Scott A. Bradford, Yusong Wang, Hyunjung Kim, Saeed Torkzaban,
Feike J. Leij, and Jiri Simunek

The vadose zone exhibits large spatial and temporal variability in many physical, chemical, and biological factors that strongly influence the transport and fate of colloids (e.g., microbes, nanoparticles, clays, and dissolved organic matter) and colloid-associated contaminants (e.g., heavy metals, radionuclides, pesticides, and antibiotics). This presentation highlights our research activities to better understand and predict the influence of specific biogeochemical processes on colloid and colloid-facilitated transport. Results demonstrate the sensitivity of colloid transport, retention, release, and clogging to transients in solution chemistry (e.g., ionic strength, pH, cation and anion type, and surfactants), water velocity and saturation, and preferential flow. Mathematical modeling at interface-, pore-, and continuum-scales is shown to be a critical tool to quantify the relative importance and coupling of these biogeochemical factors on colloid and contaminant transport and fate, which otherwise might be experimentally intractable. Existing gaps in knowledge and model limitations are identified.

Abstract

Antibiotics and Resistant Genes in the Environment as Emerging Pollutants

Tong Zhang, Ying Yang, Bing Li, Liping Ma, Xiaotao Jiang, Andong Li, Yu Deng, Yu Xia, Liguan Li, Chao Yang, Xuxiang Zhang, Ming Zhang, You Che

Environmental Biotechnology Laboratory, Department of Civil Engineering, The University of Hong Kong, Hong Kong, China

Antibiotics have been discharged into wastewater treatment plants (WWTPs) for decades. As a result, multiple classes of antibiotics have been widely detected in different WWTPs worldwide. So far, 6 classes of antibiotics, i.e. β-lactams, sulfonamides, quinolones (fluoroquinolones), tetracyclines, macrolides and others have been detected in the influents and effluents from WWTPs worldwide. The widely applied biological treatment process creates favorable condition for ARGs development and horizontal gene transfer under the sub-inhibitory antibiotic concentrations. The broad-spectrum profile of ARGs in activated sludge from a STP in a four-year period was investigated through metagenomic analysis using a structured ARGs database. HTS-based metagenomic approach was applied to investigate the profiles and fate of ARGs in a full scale WWTP. Totally, 271 ARGs subtypes belonging to 18 ARGs types were identified. PCR based molecular method and HTS-based metagenomics analysis revealed high levels of various ARGs in the plasmid metagenome as well as mobile genetic elements (MGEs) from activated sludge, including integrons, transposons and plasmids. The abundance and diversity of ARGs and MGEs were also investigated through metagenomic analysis in aquaculture farm sediments, activated sludge, biofilm, anaerobic digestion sludge, and river water. Assembled contig was proposed to for identify the host of ARGs in microbial communities. A pipeline was established for online ARGs annotation and advanced analysis. Biodegradation pathways of antibiotics and the degraders were also studied by combining UPLC-MS-MS and metagenomic analysis.

Abstract

Process Theory and Applications of Photochemical Reactors

Ernest R. Blatchley III, Ph.D., P.E., DEE

School of Civil Engineering, and Division of Environmental & Ecological Engineering
Purdue University, West Lafayette, IN, USA

Email: blatch@purdue.edu

Photochemical reactors have emerged as viable alternatives to conventional chemical or biochemical systems in many engineering applications. Among the most common photochemical reactors in use today are those that are used for disinfection of water and air, and reactors that are used to bring about chemical changes via direct photolysis or photocatalysis. Most of these reactor systems are based on ultraviolet (UV) radiation.

The focus of this presentation will be on developments made in photochemical reactor theory and their application, primarily as related to water treatment. Methods used for numerical simulation of the behavior of these systems will be discussed, along with recently developed diagnostic methods that can be used to measure the performance of these systems, including variability. Also included will be information regarding the application of UV radiation for treatment of water containing chlorinated amine compounds. This chemistry is relevant in a number of different settings, ranging from swimming pools to water reuse applications. The findings of this worked informed the development of a technology to degrade and detoxify microcystins and other important aquatic toxins.

Abstract

Soil Organic Matter Sequestration and Cycling in Manged Ecosystems

Sindhu Jagadamma

Department of Biosystems Engineering and Soil Science, The University of Tennessee, Knoxville, TN 37996, USA

Soil organic carbon (SOC) plays a key role in the global carbon (C) cycle because it represents the largest terrestrial C reservoir and it actively interacts with the atmospheric C pool. However, the SOC pool is a complex mixture of several SOC fractions and the extreme heterogeneity in chemical form and function of these fractions mediates microbial decomposition and stabilization of SOC. Since land and crop management practices considerably influence the allocation of total SOC into different fractions, it is critical to separately investigate the SOC fractions in order to understand the impact of management-induced changes in crop productivity and soil quality. Therefore I examined how long-term tillage, crop rotation and nitrogen fertilization managements influence crop productivity, soil quality and SOC stabilization of corn and soybean production systems in the Midwestern US. Results showed that long-term management practices significantly altered both the labile and stable fractions of SOC separated by physical means. We also found that a significantly proportion of organic C present in physically separated stable fraction was not chemically stable. Using atomic mass spectrometry and ^{13}C nuclear magnetic resonance spectroscopy, the chemical composition and radiocarbon age of the chemically stable SOC fraction was determined. Collectively, these research provided new and improved information for efficient crop and soil managements in the agro-ecosystems of Midwestern US.

Abstract

Environmental Systems Approaches to Bioremediation of Contaminated Sites

Terry C. Hazen and Gary S. Sayler

University of Tennessee and Oak Ridge National Laboratory, Knoxville, TN 37996, USA

While sharing many common approaches and analytical experimental tools, environmental systems microbiology differentiates itself from microbial ecology and molecular microbiology in the applied outcomes of its fundamental research agenda. These outcomes are anthropocentric in nature, ultimately directed toward understanding and ameliorating undesired environmental impacts, such as pollution stress events or predicting the consequences, quantifying risk and developing control strategies for chemical or microbial releases and discharges to the environment. Consequently, basic research questions are directed to environmental perturbation effects and the effect of the microbial community in modulating perturbations within a system that provides ecosystem services and protection for receptor populations, including humans. Case studies of environmental systems microbiology are presented.

Abstract

Uptake of Pharmaceutical Chemicals by Vegetable Crops from Water and Soil

Hui Li, Wei Zhang, Stephen A. Boyd, Ray Hammerschmidt, James Tiedje

Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI 48824, USA

Consumption of pharmaceutical-tainted fresh produce represents a direct route of human exposure. The pharmaceuticals accumulated in agricultural produce originate primarily from land application of animal manures/sewage biosolids and/or irrigation with reclaimed water. Pharmaceutical intake due to consumption of fresh produce generally indicates minimal risk to human health. However, chronic consumption of agricultural produce containing trace levels of antibiotics could potentially increase the populations of antibiotic-resistant bacteria in the gastrointestinal tracts of animals and humans. Thus, mitigating the uptake of antibiotics by vegetables during agricultural production is a crucial step in improving food safety. Reclaimed water has been increasingly used to irrigate agricultural land in many arid and semi-arid regions to promote sustainable crop production and enhance profitability. On a global basis, approximately 70% of freshwater is used for animal production and crop/vegetable irrigation. A solution to the problem of freshwater stress/shortage is to reuse agricultural water and reclaimed water for crop/vegetable irrigation. Our results suggest that water flow in soils and in vegetables is the major route by which pharmaceuticals are translocated from soils to vegetables. In addition, the trace levels of antibiotics present in soil water increase the selective pressure on soil bacteria, and promote the development and enrichment of antibiotic resistance in soil microbial communities. The translocation and accumulation of pharmaceuticals in vegetables could depend on vegetable tissue constituents, growth condition, physicochemical properties of pharmaceuticals, and soil properties. The knowledge generated from this study could be utilized to guide novel approaches aimed at minimizing pharmaceutical uptake by vegetables in agricultural production and reducing adversely impact animal and human health.

Abstract

Metagenomic Applications in Environmental Monitoring and Bioremediation

Terry C. Hazen and Stephen M. Techtmann

University of Tennessee/Oak Ridge National Laboratory, Michigan Technical University

With the rapid advances in sequencing technology, the cost of sequencing has dramatically dropped and the scale of sequencing projects has increased accordingly. This has provided the opportunity for the routine use of sequencing techniques in the monitoring of environmental microbes. While metagenomic applications have been routinely applied to better understand the ecology and diversity of microbes, their use in environmental monitoring and bioremediation is increasingly common. In this review we seek to provide an overview of some of the metagenomic techniques used in environmental systems biology, addressing their application and limitation. We will also provide several recent examples of the application of metagenomics to bioremediation. We discuss examples where microbial communities have been used to predict the presence and extent of contamination, examples of how metagenomics can be used to characterize the process of natural attenuation by unculturable microbes, as well as examples detailing the use of metagenomics to understand the impact of biostimulation on microbial

Abstract

Biocatalyst Development for Economic Advance Biofuel production at Omics Era

Shihui Yang[1, 2], Steven B. Brown[3], Min Zhang[2], and Michael E. Himmel[4],

[1]Hubei Collaborative Innovation Center for Green Transformation of Bio-resources, Hubei Key Laboratory of Industrial Biotechnology, College of Life Sciences, Hubei University, Wuhan 430062, China
[2]National Bioenergy Center, National Renewable Energy Laboratory, Golden, CO 80401; [3]Biosciences Division and Bioenergy Science Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA
[4]Biosciences Center, National Renewable Energy Laboratory, Golden, CO 80401, USA

Replacement of petroleum with lignocellulosic biofuels is critical for environmental protection, energy independence and a sustainable economy. A key barrier for economic lignocellulosic biofuel and biochemical production is the development and deployment of robust microbial biocatalysts capable of utilizing non-native substrates with high productivities and yields. Rapid technology progress in systems biology especially the next-generation sequencing (NGS)-based technologies changes the paradigm and strategies for biocatalyst development making the understanding of the biocatalysts at a global level feasible. Using *Zymomonas mobilis* as a model system, I will discuss our efforts to better understand biomass pretreatment hydrolysate inhibitor tolerance using omics-based approaches (e.g. genome resequencing, transcriptomics, and proteomics), and insights we have obtained from these studies including the genetic elements for inhibitor tolerance as well as the relationship between robustness and productivity. In addition, I will also present our work to apply public and in-house omics datasets to guide our metabolic engineering practices for economic advanced biofuel or biochemical production using lignocellulosic biomass such as heterologous 2,3-butanediol production in*Z. mobilis*. Additionally, I will discuss the technical challenges we experienced and potential solutions to address them.

Abstract

Tall Fescue (*Festuca arundinacea*) Yield and Trace Metals and Organics Uptake at High Soil Amendments Rates of a Class B Municipal Biosolids

Shawn Hawkins[1,2], Chris Borman[3], Chris Burbage, Art Meyers[2]

[1]*University of Tennessee, Department of Biosystems Engineering and Soil Science*
[2]*University of Tennessee, Center for Environmental Biotechnology*
[3]*Heritage University, Department of Chemistry*
[4]*Hampton Roads Sanitation District*

A two-year greenhouse study of tall fescue (*Festuca arundinacea*) establishment and first year yield was conducted using a silt loam soil (Lily Loam series) blended with a Class B municipal biosolids at 1%, 5%, 10%, and 50% amendment rates (dry mass basis). The 1%, 5%, and 10% amendments exceed nitrogen and phosphorus agronomic application rates for, but are representative of biosolids use at reclamation sites (e.g. abandoned mines, brown fields) where soils are manufactured for timely cover establishment and erosion control. A control treatment (0% biosolids) was fertilized according to University of Tennessee Extension recommendations using chemical fertilizers. A 50% biosolids amendment rate was used to examine cover establishment at surface disposal sites. Yields for the 1%, 5%, and 10% biosolids amendment rates were significantly higher than the control for all three harvest events in the first study year. Yields for the 5% biosolids amendment rate were higher than the control in four of five harvests during the second year of the study when the 50% amendment rate resulted in poor establishment. In both study years, the fescue nitrogen concentration (% of dry matter) was linearly correlated with the biosolids amendment rate, increasing 0.05 % N per % biosolids included in the growth media mixture ($R^2 >$ 0.90). High biosolids amendment rates (1-10%), typical of reclamation sites, clearly improve yield and productivity of newly established fescue grass.

Growth media and harvested fescue trace metal concentrations were examined to quantify plant uptake at high biosolids amendment rates. The growth media and fescue arsenic concentrations did not increase as a result of biosolids amendment and all measured fescue tissue concentrations were well below plant toxicity levels. Growth media cadmium concentrations approximately doubled as the biosolids amendment increased from 0-50% (from ≈ 0.4 to 0.8 mg/kg), but the fescue tissue concentration for the various treatments were not significantly different for most (5/8) of the harvest events. Likewise, growth media and fescue concentrations of chromium and manganese were not dramatically increased (<2-fold) by biosolids amendment.

However, both growth media and fescue concentrations of copper, magnesium, and zinc clearly increased as the biosolids amendment rate increased. For magnesium, the growth media concentration increased significantly as the biosolids amendment rate increased, from ≈ 850 to 2,500-5,000 mg/kg. A corresponding increase in the fescue magnesium concentrations was also noted, but peaked at the highest yielding 5 and 10% biosolids amendment rates (≈5,000-12,000 ppm). Measured plant tissue magnesium concentrations for the control treatment were similar to sufficiency levels (1,500 – 3,500 mg/kg), while the highest biosolids induced increases in fescue magnesium concentrations were below reported a plant critical tissue toxicity threshold (15,000 mg/kg).The growth media concentration of copper increased from 30 to 70-fold as the biosolids amendment rate increased from 0-50%, however the fescue copper concentration increased only 2-fold and stayed at or below 50 ppm. Though plant tissue concentrations over 20 mg/kg of copper are generally considered toxic, yields were high for the 1-10% biosolids treatment. Likewise, zinc growth media concentrations increased 30-40 fold as the biosolids amendment rate increased from 0-50%, but fescue zinc concentrations increased at a more moderate rate (5-10 fold) at the highest biosolilds amendment rates (10 and 50%). Fescue zinc concentrations, even at very high biosolids amendment rates, remained below croptoxicity levels (200-500 mg/kg). While high biosolids amendment rates (1-10%) did produce significant increases in the concentration of three trace metals (Mg, Cu, and Zn), the accumulation of these metals did not inhibit first year establishment and growth.

The expected uptake of trace metals from biosolids in this study served as a positive control for the uptake of trace organics, which are keenly of interest as new biosolids regulations are considered in the United States. Plant uptake of 35 organic materials was examined using root-root flare extractions (U.S. EPA Method 1694: Detection of pharmaceuticals and personal care products in Water, Soil, Sediment, and Biosolids using HPLC/MS/MS). Approximately 1/3 the trace organics investigated were present in the harvested fescue root tissue at concentrations above the EPA Method 1694 Measurement Limit: caffeine, carbamazepine, cotinine, dehydronifedipine, diphenhydramine, fluoxetine, miconozole, ofloxacin, sulfanilamide, ATC, EACTC, and Ibuprofen. The highest concentrations occurred in the most productive pot swards grown at the 10% biosolids amendment rate, and two of the compounds (diphenhydramine and miconazole) displayed clear monotonic trend across the 0-10% biosolids amendment rate treatments. However, the 1% amendment rate, which could be used for nutrient intensive forage production (fescue silage) did not produce tissue trace organics concentrations that exceeded the EPA Method Limit.

Abstract

Satellite-based modeling of the spatiotemporal variability of ecosystem respiration in the Tibetan and Inner Mongolian grasslands

Honglin He[1,2], Rong Ge[1,2], Xiaoli Ren[1], Li Zhang[1], Guirui Yu[1], Liyun Zhang[1,2], Shi-Yong Yu[3]

[1]Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China,
[2]University of Chinese Academy of Sciences, Beijing 100049, China,
[3]School of Geography, Geomatics, and Planning, Jiangsu Normal University, Xuzhou 221116, Jiangsu, China

Corresponding author e-mail: hehl@igsnrr.ac.cn

Aim Lack of the consideration of moisture effect in the existent satellite-based ecosystem respiration (RE) models, usually driven by land surface temperature (LST) and spectral vegetation indices alone, lead to poor performance in water-limited regions. Here we present a remote-sensing RE model by comprehensively considering the effects of temperature, plant productivity, and moisture, then to investigate the spatiotemporal variability of RE and the associated controlling factors in the under-studied northern China's grasslands.

Location Tibetan Plateau and Inner Mongolian Plateau

Methods The MODIS LST, enhanced vegetation index (EVI), and land surface water index (LSWI) were utilized to formulate a statistical-mechanistic RE model. Flux measurements between 2003 and 2013 from 16 grassland sites across northern China were used for model parameterization and validation.

ResultsThe model well explained the observed RE in both the Tibetan grasslands (R^2=0.79, RMSE=0.77 g C m^{-2} day^{-1}) and the Inner Mongolian grasslands (R^2=0.75, RMSE=0.60 g C m^{-2} day^{-1}). The temporal variations of RE can be described as a unimodal curve peaking in July or August; and the temporal variability in the Inner Mongolian Plateau is significantly greater than that in the Tibetan Plateau. The spatial RE decreases from southeast to northwest in the Tibetan Plateau, while it decreases from northeast to southwest in the Inner Mongolian Plateau.

Main conclusions The inclusion of mean growing season LSWI and 8-day LSWI-driven Michaelis-Menten equation as the water-limiting factor can substantially improve the performance of RE model in arid and semi-arid ecosystems. Plant productivity and moisture, but not temperature, can best explain the spatial pattern of RE in both the Tibetan Plateau and Inner Mongolia Plateau. Regarding the temporal variability of RE, in the Tibetan Plateau, temperature plays a major role, while in the Inner Mongolian Plateau, moisture appears to be equally important as temperature.

Abstract

Biodegradable Plastic Agricultural Mulches: Microbial Degradation and Impacts on Soil Ecology

Jennifer M DeBruyn, Sreejata Bandopadhyay, Henry Sintim, Marie English, Xianfang Wen, Sean Schaeffer, Markus Flury, Doug Hayes

Plastic mulch films are used in fruit and vegetable agriculture to reduce weed growth, conserve moisture, and increase soil temperatures. Conventional plastic mulch films are made of polyethylene (PE) plastic. PE is not biodegradable, and thus imposes considerable end-of-life costs, both in terms of removal and disposal expenses, and environmental impacts of PE fragments left behind in the soil. Several biodegradable plastic mulches (BDMs) from bio-based or other biodegradable polymers (e.g. starches, PBAT, PLA, and other polyesters) are now available and present a viable alternative to PE that can be tilled into the soil at the end of the growing season. However, the decomposition fate of BDMs and impact on soils is not well understood; this is a primary concern with growers who are considering adoption of biodegradable plastics. The goal of this study is to 1) determine the impact of BDMs on the soil environment in long term cropping experiments in two different soils and climates and 2) understand the microbial degradation of these materials. Randomized block trials of pumpkins planted with four different BDMs, conventional PE film, cellulosic ground cover and bare ground were conducted in Knoxville, Tennessee and Mount Vernon, Washington, USA. Generally, BDMs increased soil temperature compared to bare ground; however, only two of the four BDMs had comparable soil temperatures with PE. After the first growing season with BDMs tilled into the soil, we assessed the soil quality in terms of carbon, nutrients, chemistry (pH and electrical conductivity), bulk density, respiration and infiltration. There were significant differences in soil quality between the two locations. However, except for small differences in nitrate and conductivity, there were no other significant differences in soil quality parameters among the BDM and PE treatments. To better understand the degradation of these materials, soil microcosms and enrichment cultures were set up in the laboratory. In soil microcosms, degradation of BDMs was enhanced under higher temperature. In microcosms treated with a starch-based BDM, the response range was from 10 to 30°C, whereas the range for a PLA-based BDM was more constrained from 20 to 30°C. For both BDMs, soil C storage was greatest at an intermediate temperature (20°C). Confocal microscopy confirmed increased microbial growth on the films at higher temperatures. Enrichments of microbial consortia on minimal media with plastics selected for a degradative community, as evidenced by significantly elevated CO_2 production compared to uninoculated controls. Strains isolated from enrichments included a *Rhodococcus* sp. and *Bacillus* sp. which were capable of degrading multiple BDMs in culture. Taken together, the lab studies have demonstrated microbially-mediated degradation of the plastics and provided a foundation for examining biochemical mechanisms of biodegradable plastic catabolism by soil microbes.

Abstract

Understanding the Environmental Link to Obesity: The Story of Parabens

Ling Zhao
The University of Tennessee, Knoxville, TN 37996, USA

The prevalence of obesity has risen dramatically around the world over the last two decades. Similar rising trends are also seen in the prevalence of obesity-associated metabolic disorders, such as type 2 diabetes (T2DM) and metabolic syndrome (MetS). Accumulating evidence suggests that obesity epidemic could be due to *chronic environmental chemical exposures*. In other words, environmental exposure to certain chemicals, especially during developmental programming period, increases the risk of developing obesity and obesity-associated metabolic disorders, such as T2DM, and MetS later in life. Therefore, there is a pressing need to identify and understand new environmental compounds that act as obesogens (i.e., chemicals that induce obesity) and negatively impact the metabolic health.

Parabens are a group of alkyl esters of p-hydroxybenzoic acid and typically include methylparaben, ethylparaben, propylparaben, butylparaben, and benzylparaben (Fig. 1).The parabens (or their salts) are widely used as preservatives in cosmetics, toiletries, food, and pharmaceuticals [1]. Further analysis has reported that parabens are ubiquitously detected in surface water, soils, sediments and sludge [2]. Systemic absorptions of parabens into the human body, possibly through oral ingestion and skin penetration, are suggested by the detection of parabens (both free and conjugated forms) in human serum and urine from both general adult population and children/infants. Strikingly, parabens have also been detected in the human placenta tissue and breast milk, indicating health risks of early life exposure to paraben in humans. Based on the existing results, parabens are considered asendocrine disrupting compounds (EDCs). The major health concerns associated are their estrogenic potential and possible involvement in breast carcinogenesis [3].

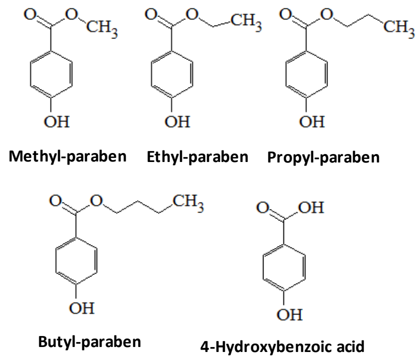


Fig. 1 Chemical structure of Parabens and their common metabolite.

Using cell and animal approaches, our laboratory is among the first to demonstrate the effects of parabens exposure on adipogenesis and adiposity in vitro and in vivo [4, 5]. Also, our preliminary results demonstrate that parabens can drive multipotent stem cells towards fat cell fate at the expense of other cell types, such as bone and chondrocytes. These results suggest that paraben exposure could be implicated in obesity and bone health. Overall, results from our studies and others suggest that paraben exposure may pose potential health risks to humans. Future studies on paraben exposure and human health are warranted.

Abstract

Biochar Technology in the Nexus of Food, Energy, Water, and Soil Systems

Wei Zhang[1, 2], Hui Li[1], Stephen A. Boyd[1], Dongqiang Zhu[3]

[1]*Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI 48824, USA*
[2] *Environmental Science and Policy Program, Michigan State University, East Lansing, MI 48824, USA*
[3]*School of Urban and Environmental Sciences, Peking University, Beijing 100871, China*

Biochar is a class of charcoal-like porous materials produced from thermal decomposition of organic materials under oxygen-limited condition (i.e., pyrolysis), and can be generated from bioenergy production in engineered facilities or agricultural waste management such as crop residue burning. Pyrolysis converts one part of carbon in organic feedstock (e.g., woody biomass, crop residue, animal manure, sewage sludge, etc.) into bioenergy and the reminder into much more recalcitrant form of carbon resistant to degradation. Physicochemical properties of produced biochar could be engineered for intended use through optimizing pyrolysis parameter and feedstock type. Currently oneof major biochar uses under consideration is land application for agronomic and environmental benefits such as increasing soil carbon storage, improving soil and water quality, increasing crop yield, and immobilizing contaminants *in situ*. Therefore, biochar technology is in the nexus of food, energy, water and soil systems. In particular, we have recently studied the immobilization of organic contaminants (e.g., pharmaceuticals, pesticides, or aromatic compounds) by biochar, which in turn could reduce the transport and biological uptake of contaminants in agroecosystems. Our results demonstrated that biochar technology could be promising in reducing soil, water, and food contamination, and improving the sustainability and resilience of agricultural production systems. Nonetheless, many scientific, technological, and socioeconomic questions remain to be answered before large-scale adaptation, demanding concerted effort from diverse stakeholders such as scientists, engineers, farmers, and policymakers.

Abstract

Life Cycle Performance of Biofuels from Microalgae: the GHG Emissions, Energy, Water, Land and Co-products

Yizhen Zhang and Alissa Kendall

Civil and Environmental Engineering Department, Industrial Ecology Program, University of California, Davis, CA 95616, USA

Interest in microalgae-derived (algal) biofuels is growing because microalgae have high productivity and high oil content compared to terrestrial energy crops, and growth requires significantly less land area and no fertile cropland, thus results no competition with food crops. However, microalgae require a large amount of fertilizer during cultivation to achieve high oil productivity, and energy inputs during algae harvest and subsequent dewatering are energy intensive. Estimated greenhouse gas (GHG) emissions from algal biofuel varied in a wide range from 20 to 500 g CO_2 per MJ. Co-product from the production system sometimes plays an important role for determining the environmental performance of the biofuel. The co-product can be consumed within the system for recycling carbon, nutrient and energy or can be used for producing high value co-products. What is the best strategy of handling the co-product remains a question and needs to be assessed.

This study develops a model to examine life cycle GHG emissions and energy use of renewable biofuel production from microalgae in open raceway pond. The environmental performance of algal biofuels from the two most discussed oil conversion technologies (or pathways) are compared: renewable diesel production from hydrothermal liquefaction and biodiesel production from lipid extraction. The environmental performance of hydrothermal liquefaction technology is assessed using a general kinetics model that estimates bio-crude yields under various operation conditions. The operation condition that yields high crude oil, requires low energy inputs and generates low GHG emissions is selected for further co-product analysis. Both pathways are tested with multiple co-product utilization possibilities and various allocation methodologies. Recommendations for environmentally preferable co-product uses are provided based on the results. The system description is illustrated in Fig. 1.

Algal residues from biodiesel production are not currently used in cattle feed, so in this model displacement estimates are calculated using a feed optimization model that develops least-cost rations based on nutritional composition and cost. While displacement credits are large and seemingly lead to a very low-carbon fuel, they are a function of methodological choices and uncertain displacement assumptions. The use of co-products within the production system (for recycling energy, carbon and nutrient flows) lead to an emissions intensity estimate that is higher, but more robust because it is not subject to market conditions and methodological debate.

Abstract

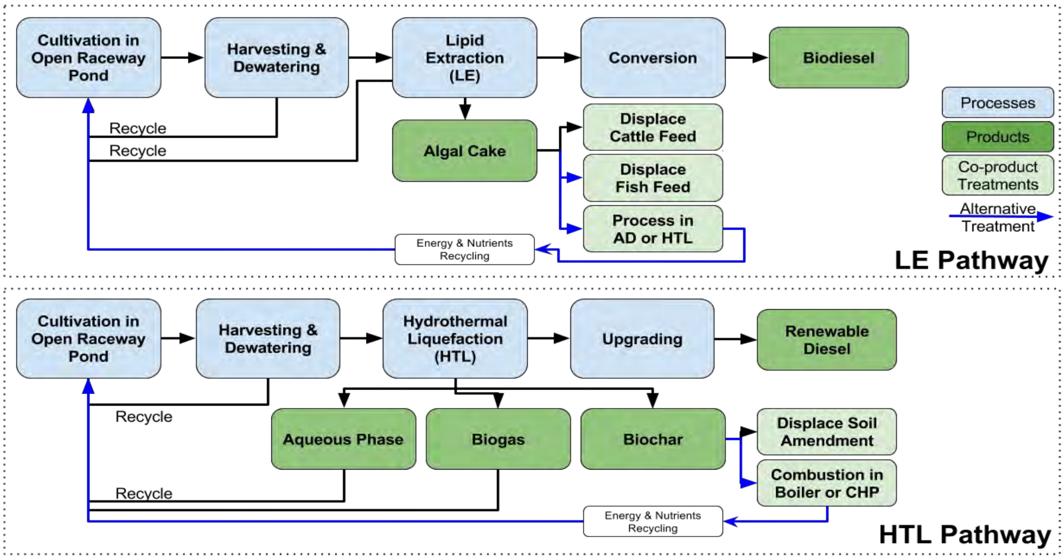


Fig.1: Illustration of the System

Abstract

Reaction Condition Effects on Re(VII) Sorption Kinetics at the Zero Valent Iron-Water Interface

Yuji Arai

Department of Natural Resourecs and Env Sci.University of Illinois at Urbana-Champaign
Urbana, IL 61801, USA

Technetium-99 (^{99}Tc) is a low level radioactive waste product resulting from uranium fission processes in nuclear reactors. Currently, the U.S. Department of Energy (DOE) has been investigating solidification and stabilization methods via reductive precipitation of mobile $Tc(VII)O_4^-$ to Tc(IV) oxides and sulfides for long term waste storage purposes. They are seeking effective reducing agents for the current cement formulation to optimize the Tc immobilization technology. In this study, the reducing capacity of synthetic zero valent iron (ZVI) was evaluated using a chemical analog of $^{99}TcO_4^-$, perrhenate (ReO_4^-). The objective was to evaluate the extent and kinetics Re(VII) reduction under simulated conditions (i.e., high pH and high nitrate concentrations) in low level radioactive waste storage tanks at DOE sites.

The borohydride based synthetic ZVI was used in the Re(VII) sorption experiments at various pH and [$NaNO_3$].Batch methods were used for the reduction kinetic experiments using various carbonate buffer solutions (pH 8.3-10.2) under varying [nitrate]:0, 0.001, 0.01 and 0.1M. Kinetic samples were taken at 10 min, 30 min, 1, 3, 6, 12, and 24 hrs. The extent of sorption decreased with increasing pH from 8.3 to 10.2. Interestingly, pseudo 2nd order kinetic rates increased with increasing [nitrate] which was attributed to co-adsorption of ammonium (i.e., a reaction product of reduced nitrate by ZVI), facilitating electrostatic attraction towards perrhenate under alkaline conditions. X-ray absorption spectroscopic analysis indicated the formation of $Re(IV)O_2(s)$ as the reaction products, suggesting that Re(VII) sorption was attributed to the reductive precipitation reaction. Considering the thermodynamically favorable reduction of Tc(VII) over Re(VII), ZVI might have potential for improving the reduction capacity of the current CWT.

Abstract

Study, Research, and Life at the University of Tennessee

Lidong Li

Department of Biosystems Engineering and Soil Science, The University of Tennessee, Knoxville, TN 37996, USA

I started at the University of Tennessee from August, 2014 in the Institute of Agriculture, Department of Biosystems Engineering and Soil Science, studying environmental and soil science. The topic of my Ph.D. dissertation is the impacts of climate change and conservation management on sequestration of newly added carbon in soil. Soil organic carbon can be stored in a relatively rapidly cycling active pool, or a more slowly cycling passive pool. Climate change and conservation management affect the allocation of newly added carbon into each pool. Climate change is altering ecosystem function, which will persist for centuries. The consequences of climate change, specific to agro-ecosystems, include changes on agronomic productivity, and consequently food security. Conservation management, such as no-tillage farming and cover crops, are effective strategies to sustain soil carbon content, therefore sustain agronomic productivity. However, how climate change and conservation management will affect the fate of newly added carbon in each pool is still unclear. Understanding those effects is critical for predicting soil carbon stability and stock in long term. Besides study and research, there are a lot fun stuff to do. I went to many great places, met many cool people and made many good friends. I appreciate that I have the opportunity to see this wonderful landscape and experience the different culture.

Abstract

Agricultural Adaptation to Climate Change: the Role of Technologies and Institutions

Jinhua Zhao

Department of Economics, Department of Agricultural Food and Resources Economy, Environmental Science and Policy Program, Michigan State University, East Lansing, MI 48824, USA

Agriculture's ability to adapt to global climate change depends critically on the adoption of efficient technologies and effective institutions. Even though new technologies can improve crop yields and agricultural profits, they do not necessarily alleviate pressure on limited resources such as water, energy and the environment. Institutional innovations are needed to ensure that new technologies improve agricultural sustainability. Using US data, I analyze the major factors affecting the adoption of irrigation technologies and environmental friendly farming practices, and evaluate their environmental impacts. I further show how institutions such as water rights can be enhanced to improve the environmental impacts of the new technologies.

Abstract

Development of an Indicator Approach to Assessing Bioenergy Sustainability

Esther Parish and Virginia Dale

Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA

Oak Ridge National Laboratory's (ORNL's) interdisciplinary Center for BioEnergy Sustainability (CBES) supports the US Department of Energy's (DOE's) BioEnergy Technologies Office (BETO) by:(1) researching ways to define environmental and socioeconomic costs and benefits of bioenergy systems, (2) quantifying opportunities and risks associated with sustainable bioenergy in specific contexts, and (3) communicating the challenges and paths forward for sustainability to a range of stakeholders. Over the past several years, ORNL CBES has developed an indicator approach of assessing progress toward sustainability across different geographic contexts and feedstock choices. This talk presents a recent case study application of ORNL's recommended suite of 35 indicators (representing 12 environmental and socioeconomic categories) to a five-year switchgrass-to-ethanol production system based in East Tennessee. The case study results indicate that it is possible to assess a bioenergy system's sustainability by integrating multimetric information gathered from across a variety of spatial and temporal scales. Even in the absence of complete information, the integration of qualitative indicator ratings can increase holistic understanding of a bioenergy system's sustainability relative to alternative land use scenarios.

Abstract

Amendment-induced Immobilization of Heavy Metals in Contaminated Soils: Mechanisms and Applications

Jingke Sima, Zhenliang Ding, Xinde Cao*

School of Environmental Science and Engineering, Shanghai Jiao Tong University, Shanghai 200240, China

*Corresponding author e-mail: xdcao@sjtu.edu.cn

The amendment-induced immobilization of heavy metals has been considered as a cost-effective and easily-operational method for remediation of contaminated soils. This method relies on the addition of soil amendments to convert heavy metals into in the stable forms by sorption, precipitation, complexation, ion exchange or redox process, thereby decreasing mobility and bioavailability of contaminants. In this presentation, a review was made on the development of our research on such an immobilization treatment with more attention paid to the molecules mechanism and field demonstration.

Phosphate rock (PR) shows the highest affinity for Pb, followed by Cu and Zn, with the sorption capacities of 138, 114, and 83.2 mmol kg^{-1}, respectively. The greatest stability of Pb retention byPR can be attributed to the formation of insoluble fluoropyromorphite ($Pb_5(PO_4)_3F$), which was primarily responsible for Pb immobilization (up to 78.3%), with less contribution from the surface adsorption or complexation (21.7%), compared to 74.5% for Cu and 95.7% for Zn. Combination of PR with $FeSO_4$ was effective in simultaneously immobilizing Zn and Cr(VI) within the tested solution pH range of 5.5–8.5. Over 95% Zn and Cr(VI) was removed by PR with $FeSO_4$. Zn was stabilized via formation of insoluble minerals such as $Zn_3(PO_4)_2$ or $CaZn(CO_3)_2$while Fe^{2+} induced reduction of Cr(VI) into stable $Cr(OH)_3$ or $Cr_xFe_{(1-x)}(OH)_3$ which was responsible for Cr(VI) immobilization.

Field demonstrations were conducted in a heavy metal contaminated soil at an abandoned battery recycling site. All P amendments were effectively transformed soil Pb into stable forms. TCLP-Pb in the P-treated soils was reduced from 82 mg L^{-1} to below EPA's regulatory level of 5 mg L^{-1} in the surface soil after 100-d treatment. Lead immobilization was attributed to the P-induced formation of chloropyromorphite ($Pb_5(PO_4)_3Cl$). In another field trial, input of PR with $FeSO_4$ into an abandoned electroplating contaminated soil reduced the TCLP extractable Zn and Cr(VI) by 40% and 94%, respectively, after 120-d treatment, compared to the untreated soil.

Abstract

Metabolic engineering of *Klebsiella pneumoniae* for chemicals production

Jian Hao, Jiping Shi

Lab of Biorefinery, Shanghai Advanced Research Institute, Chinese Academy of Sciences, No. 99 Haike Road, Pudong, Shanghai, 201210, PR China

Corresponding author Tel.: +86 21 20325163; E-mail address: haoj@sari.ac.cn

2,3-Butanediol synthesized by *K. pneumoniae* was a mixture of the three stereoisomers. The mechanism of 2,3-butanediol stereoisomers synthesis pathway was revealed. Glycerol dehydrogenase, encoded by *dhaD*, exhibited 2R,3R-butanediol dehydrogenase activity and was responsible for 2*R*,3*R*-butanediol synthesis from R-acetoin. This enzyme also contributed to *meso*-2,3-butanediol synthesis from S-acetoin. Butanediol dehydrogenase, encoded by *budC*, was the only enzyme that catalyzed the conversion of diacetyl to S-acetoin and further to 2*S*,3*S*-butanediol.

R-acetoin is an intermediate of 2,3-butanediol production. *K. pneumoniae* Δ*budC* accumulated high levels of *R*-acetoin in culture broth. At the optimized conditions, 62.3 g/L *R*-acetoin was produced.

K. pneumoniae Δ*budA* was found was found to execrate an unknown chemical at a high titer. Later this chemical was identified to be 2-ketogluconicacid, which was formed through the glucose oxidation pathway in *K. pneumoniae*. Under optimum conditions, a total of 186 g/l 2-ketogluconic acid was produced

The glucose oxidation pathway is located in the periplasmic space and gluconic acid is an intermediate. It was found that, deletion of the *gad* gene in *K. pneumoniae*, resulting in loss of gluconate dehydrogenase activity, led to the accumulation of gluconic acid in the culture broth. After optimization a final level of 420 g/L gluconic acid was produced in fed batch fermentation.

Similar to gluconic acid, xylose can be converted to xylonic acid by *K. pneumonia*. In fed batch fermentation more than 100 g/L xylonic acid was produced with the conversion ration 1.11 g/g. Using the hydrolysate of bamboo as substrate, mixture of 33 g/L gluconic acid and 14 g/L xylonic acid were produced by *K. pneumoniae Δgad*.

Abstract

Development of advanced materials and technologies for efficient treatment of emulsified oily wastewater

Hongting Zhao*

College of Materials & Environmental Engineering, Hangzhou Dianzi University

Corresponding author Tel.: 13656631588 email：hzhao@hdu.edu.cn

At present, oily wastewater causes severe environmental and ecological problems and also threatens the life of human beings. The oily wastewaters are generally arisen from oil industry and oil spill accidents, and the oil often occurs as emulsified form, making it extremely difficult to separate the oil from the water phase. Traditional treatment approaches for emulsified oil wastewaters, such as air flotation, electrochemistry method, adsorption separation and biochemistry methods, generally are not efficient enough to achieve satisfactory cleanup. As a consequence, it is necessary to develop new cost-effective technologies that are able to efficiently remove emulsified oil from aqueous environment. In this study, a class of mulitifunctional and reusable nanoparticles (MNPs) was developed for effectively removing emulsified oil droplets from aqueous media.

Abstract

The Dual Effects of Selenium at Environmentally Realistic Concentrations in Aquatic Organisms

Lingtian Xie[1*], Xing Wu[1], Hongxin Chen[1], and Paul L. Klerks[2]

[1] *Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, Liaoning 110016, P. R. China*
[2] *Department of Biology, University of Louisiana at Lafayette, Lafayette, LA 70504, USA*

Corresponding author e-mail: xielt@iae.ac.cn

Selenium is an essential element for animals. Adverse effects are shown in either excess or deficient states. The dual effects of selenium at environmentally realistic concentrations are evaluated in a benthic invertebrate (the California blackworm *Lumbriculus variegates*) and a fish (the least killifish *Heterandria formosa*). Worms were exposed to 20 µg/g dry weight of selenite (Se(IV)), selenate (Se(VI)), or seleno-l-methionine (Se-Met) in their diet (sediment) or to 15 µg/L dissolved Se in water-only exposures. Se accumulation, worm population growth, lipid peroxidation (as TBARS), and Na^+/K^+-ATPase activity were quantified. The sediment Se-Met exposure caused 100% mortality, while worm densities were reduced by the other exposures except the Se(VI) one. Se bioaccumulation was generally higher for the sediment-Se exposure than the dissolved-Se ones. The Se accumulation was highest for Se-Met. The oligochaetes that accumulated Se had higher levels of lipid peroxidation and reduced Na^+/K^+-ATPase activity. The fish were pre-exposed to an environmentally relevant concentration (2 µg/g dry wt) of dietary selenite(IV) or seleno-L-methionine (Se-Met) for 10 d. The same fish were then exposed to 0.5 mg/L of Cd for 5 d. Both Se(IV) and Se-Met rapidly accumulated in *H. formosa*. Results for the two Se species were generally similar in this study. Fish exposed to Se had lower levels of lipid peroxidation and a higher catalase (CAT) activity. In contrast, their Na^+/K^+-ATPase activity was reduced. The Cd exposure resulted in an increase in lipid peroxidation and decreases in the activities of catalase and Na^+/K^+-ATPase. The Cd-exposed fish that were pre-exposed to Se had lower Cd body burdens, less lipid peroxidation, and higher catalase activity, than did fish not pre-exposed to Se. The Se exposure did not have a protective effect on the Cd-induced reduction in Na^+/K^+-ATPase activity. The present study's findings demonstrate that benthic organisms are simply the conduits of Se from primary producers to higher trophic levels but themselves adversely affected by Se exposure The effects are generally but not exclusively a function of Se body burdens, underscore the need for research on these issues in invertebrates. Moreover, the results imply that the dietary uptake route is the predominant one for Se accumulation in *L. variegatus*. The results clearly demonstrate that a Se-enriched diet reduces some (but not all) forms of Cd-toxicity and that Se can simultaneously have beneficial and detrimental effects,

Abstract

making it difficult to predict the net outcome of changes in dietary Se levels for fish.

Abstract

Biocatalyst Development for Economic Advance Biofuel production in Omics Era

Shihui Yang[1, 2*], Steven B. Brown[3], Min Zhang[2], and Michael E. Himmel[4],

[1]*Hubei Collaborative Innovation Center for Green Transformation of Bio-resources, Hubei Key Laboratory of Industrial Biotechnology, College of Life Sciences, Hubei University, Wuhan 430062, China;*
[2]*National Bioenergy Center, National Renewable Energy Laboratory, Golden, CO 80401;*
[3]*Biosciences Division and Bioenergy Science Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831;*
[4]*Biosciences Center, National Renewable Energy Laboratory, Golden, CO 80401*

Corresponding author e-mail: shhyoung@hotmail.com

Replacement of petroleum with lignocellulosic biofuels is critical for environmental protection, energy independence and a sustainable economy. A key barrier for economic lignocellulosic biofuel and biochemical production is the development and deployment of robust microbial biocatalysts with high productivities and yields. Rapid technology progress in synthetic biology and systems biology especially the next-generation sequencing (NGS)-based technologies changes the paradigm and strategies for biocatalyst development making the understanding of the biocatalysts at a global level feasible. I will discuss our efforts to better understand biomass pretreatment hydrolysate inhibitor tolerance for microorganisms using omics-based approaches (e.g. genome resequencing, transcriptomics, and proteomics), and insights we have obtained from these studies including the genetic elements for inhibitor tolerance as well as the relationship between robustness and productivity. In addition, I will also present our work to apply public and in-house omics datasets to guide our metabolic engineering practices for economic advanced biofuel or biochemical production using lignocellulosic biomass such as heterologous 2,3-butanediol and farnesene production in Z. mobilis. Additionally, I will discuss the technical challenges we experienced and potential solutions to address them.

Abstract

Maximizing of cellulosic ethanol potentials by minimizing energy input and waste water generation in lignocellulose biorefining

Jie Bao

State Key Laboratory of Bioreactor Engineering, East China University of Science and Technology, 130 Meilong Road, Shanghai 200237, China

Corresponding author e-mail: jbao@ecust.edu.cn

Decades of efforts on lignocellulose biorefinery technology had made great achievements, but it is still not competitive to petro gasoline and the corn based ethanol. Large gaps to corn based process still exist. This study reports the latest advances on dry mill biorefinery process (DMBP) on ethanol and biochemicals production from lignocellulose feedstock. The modified dry dilute sulfuric acid pretreatment (DDAP) leads to the zero wastewater generation and significant reduction of energy input, reactor corrosion while maintains the high pretreatment efficiency. Inhibitors in the solid pretreated lignocellulose are completely and quickly removed by a unique biodetoxification fungus Amorphotheca resinae ZN1 with zero wastewater generation and energy input. The high solid saccharification and co-fermentation converts glucose from cellulose and xylose from hemicellulose into ethanol with high titer (104 g/L of ethanol as the maximum) with the least energy input and wastewater generation. The process flowsheet was re-designed to shape a new biorefinery processing platform technology. The minimum ethanol selling price (MSEP) was calculated based on Aspen plus modeling. Results show that the DMBP technology is close to the corn based technology in the conversion yield, energy input, waste water generation and the overall cost. Several byproduct credits were tested by lignin residue combustion for power generation, lignin combustion ash as alternative phosphate and potassium fertilizer, decentralized pretreatment operation to the collection depot are also discussed. The study provides a promising platform technology of lignocellulose processing which is comparable to corn based technology with the merits of low energy input, minimum waste water generation, cheap hardware investment, and easy operation.

Abstract

A new ecological treatment technology for the wastewater treatment of Nitrogen, phosphorus and organic pollutants

Jin shui Wu*

Institute of Subtropical Agriculture, Chinese Academy of Sciences, China

Corresponding author e-mail: jswu@isa.ac.cn

The water pollution caused by nitrogen, phosphorus, COD and other organic pollutants, has been raising as one of the serious environmental pollution problems in the southern region of China. Through eight years of scientific research, the research team led by Professor Jinshui Wu from the Institute of Subtropical Ecology, Chinese Academy of Sciences, has developed a new technology system of ecological treatment of organic matter and nitrogen and phosphorus pollutions. Its key idea is the ecological management technology of *Myriophyllum elatinoides*.

The technology system has been adopted in 112 application cases of wastewater treatment across the nine southern provinces of China. Based on data for monitoring of wastewater treatment in all application cases more than one years, our experimental results demonstrated that the concentrations of COD, N and P pollutants of water volumes of outlets in the cases of livestock wastewater treatment projects were close to the standard values of 1/5~1/3, which are required by the national safe discharge standard of pollutants for livestock and poultry breeding wastewater (GB18596-2001). The water quality in application cases of rural domestic sewage treatment projects, is up to the A class of first-class standard by the national safe discharge standard of pollutants for municipal wastewater treatment plant（GB18918-2002）. In the cases of the treatment projects of the eutrophicated rivers, the concentrations of COD, ammonia nitrogen and total phosphorus decreased by 60-80% and the visibility of the water body was more than 1 meter.

Abstract

Environmental Chemistry of As/Sb in Soil-Plant System

Zhou Dongmei*, Cui Xiaodan, Wang Yujun

Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, China

Corresponding author e-mail: dmzhou@issas.ac.cn

Arsenic (As) and antimony (Sb) belong to the same group of the periodic table that they share some chemical properties. China is the biggest Sb producer in the world and most of its large or superlarge Sb mine are located in the south-west of China, where the staple food people live on is rice (*Oryza sativa* L.). In recently years, mining and smelting of Sb increased with the increasing demand of Sb, which brought about serious Sb pollution to soils and plants near Sb mines, and usually, Sb contamination is accompanied with As elevation. The aim of this work is to affect the availability of As and Sb through water management and thus reduce the uptake of Sb by rice. Based on field survey, and combined with HPLC-ICP-MS, LA-ICP-MS, μ-XRF, and μ-XANES, As and Sb speciation in soils and corresponding rice plants were characterized. Based on indoor soil cultivation experiments, effect of flooding and wet-drying on the release of Sb from the soils was investigated. Based on hydroponics, effect of iron plaque on the uptake of different Sb species was explored with μ-XRF and μ-XRD. And finally, greenhouse experiments were done under different water management, the uptake mechanisms were discussed primarily.

Key Words: Arsenic; Antimony; Rice; Water management; Bioavailability

Abstract

Study on rice absorbing cadmium repressed by photosynthetic bacteria under the stress of high concentration of cadmium

Zhao Yuan* Liu Jiazeng, Wang Leyang, Sun Cenpeng,Ying Hongyang and Ji Yun

School of Environmental and Safety Engineering, Changzhou University, Changzhou 213016, China

Corresponding author e-mail: zhaoyuan@cczu.edu.cn

The pot experiment was used to study the effect of rice absorbing Cd repressed by photosynthetic bacteria under the stress of high concentration of Cd . The results showed that with high concentration of Cd pollution, the growth of rice was greatly inhibited and the biomass was decreased sharply.After adding photosynthetic bacteria,the absorption of rice to Cd was better repressed. But the high concentration of Cd may also cause serious inhibition to photosynthetic bacteria, such as photosynthetic bacteria has a good effect on rice absorbing Cd in 40 mg /kg Cd contaminated soil , but with the increase of Cd concentration, the repression effect was weakened. The study also found that in soil with high concentration of Cd, composite agent made by photosynthetic bacteria and bacillus with use level of 30 kg / mu , can well control the content of Cd about 0.2 mg /kg in rice, which is Grain limit standards . Furthermore, 30 kg/mu of photosynthetic bacteria can decrease the content of Cd in rice to 0.14 mg/kg in 40 mg /kg Cd contaminated soil.

Key words: rice; photosynthetic bacteria; biomass; Cd stress

Abstract

Evolvement of dimension and resolution of element availability evaluation based on a passive sampling technique

Dong-Xing Guan*

Key Laboratory of Surficial Geochemistry, Ministry of Education, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China

Corresponding author e-mail: dxguan@nju.edu.cn

Element availability evaluation is critical to unravel the biogeochemistry of nutrients and contaminants in ecosystems. Since the invention of the first passive sampler for organic micro-pollutants in water in 1987, especially the DGT (diffusive gradients in thin-films) passive sampler for trace metals initially in 1994, diffusion-based passive sampling techniques has undergone thriving development and application. The samplers, such as DGT, not only act as a monitoring tool for nutrients/contaminants, especially their available/labile fractions/fluxes, but also provide *in situ* kinetics information. In this presentation, DGT will be taken as an example to track the evolvement of dimension and resolution of element availability evaluation. Till now, DGT is available for effectively measuring > 50 elements in the periodic table. Most occasions, DGT is adopted to measure nutrients (such as phosphate) and trace metals (such as Pb, Zn, Ni, As, Sb and Mo). The dimension using DGT has evolved from single-spot (0D) and time-series measurement to vertical profiling (1D) and 2D imaging, whereas the spatial resolution varies from typically centimeter and millimeter to sub-millimeter (tens to hundreds of micrometers). The biochemical heterogeneity nature, both vertically and horizontally, of environmental media and micro-interfaces calls for approaches capable of providing 2D solute distribution/flux information. With the implementation of 2D sub-mm high-resolution DGT, complemented with planar optodes, a fluorescence-based imaging technique, element behavior in aquatic/terrestrial hotspots and across micro-interfaces is promising to be delicately elucidated. It's exciting and believed that with the development of passive samplers and the follow-up element detection systems, and the more available complementary techniques, such as soil zymography, the dimension and resolution of element availability evaluation will be probably upgraded.

Abstract

Abstract

Seasonal climate variation impacts on soil microbial community in forest ecosystems

Ang Hu[1], Weijun Shen[2], Guirui Yu[3], Nianpeng He[3], Shirong Liu[4], Gengxin Zhang[1*]

[1]Key Laboratory of Alpine Ecology and Biodiversity, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, 100101, China

[2]Center for Ecology and Environmental Sciences, South China Botanical Garden, the Chinese Academy of Sciences, Guangzhou, 510650, China

[3]Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China

[4]Key Laboratory of Forest Ecology and Environment, China's State Forestry Administration, Research Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry, Beijing 100091, China

Corresponding author e-mail: zhangg@itpcas.ac.cn

The timing of plant biological events response to seasonal change is well known, while the nature of dynamic of soil microbial community in response to seasonal rhythm remains elusive. In this study, we synthesize microbial community data, compare seasonal microbial population dynamics among forest ecosystems across large-scale geoclimatic regions in the Eastern China to assess the impacts of seasonal climatic fluctuations on microbial population dynamics and to test soil microbial "phenology" hypothesis. Seasonal soil samples were collected from five forests over two years from 2013 to 2014, and microbial communities were analyzed by 16S rRNA gene amplicon sequencing and molecular ecological network approaches. Our results revealed distinctly different patterns of microbial communities in northern versus southern latitudinal forests, with smaller compositional changes over time in southern than northern latitudinal forests. The microbial turnover rate exhibited large-scale geographical variation, which was more slow in southern than northern latitudinal forests, especially at seasonal timescale (60-183 and 183-365 day). Phylogenetic community structure (ses.MNTD values) and molecular ecological networks of soil microbial communities showed southern latitudinal forests have more phylogenetically clustered community and more intensified species-to-species interactions than northern. Statistic analysis suggested that seasonal temperature variation impacts on seasonal of turnover rate of soil microbial community through its influence on soil properties such as water and nitrate conditions. Therefore, we infer that larger seasonal climate fluctuations were associated with higher microbial community dynamics, less phylogenetically clustered community and less intensified species-to-species interactions of soil microbial community. Our study provides new insight into the impacts of climate variation on the soil microbial communities, which is important in predicting how they respond to global warming in the future.

Abstract

Bioassay-directed identification of specific toxicants in waste water from industrial parks

Wei Shi*, Dongyang Deng, Xiaowei Zhang, Hongxia Yu*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, PR China.

Corresponding author e-mail: njushiwei@nju.edu.cn

Water treatment plant is always designed to reduce the concentrations of conventional indicators but not the specific pollutants, which may bring toxicants and cause adverse effects to receiving water. Nowadays the campaign against specific toxicants in waste water from industrial plant is called in China, but limited technique is available to identify and control the specific pollutants. In the present study, instrumental analysis and bioassays were carried out to identify the major toxicants in sewage of industrial plant. Wastewater were analysed by following the protocol of toxicity identification and evaluation (TIE) based on *Daphnia magna*. Organic compounds were showed to be the main toxicants, according to physical and chemical processing including pH adjustment, aeration, filtration, solid phase extraction, the addition of EDTA and $Na_2S_2O_3$. Effect directed analysis (EDA) was further carried out for the fractionation and analysis of the organic extracts. The results showed that fraction F1-3, F1-4, F1-5 and F1-7 were responsible for the toxicity. Nontarget screening based on quadrupole time-of-flight mass spectrometry (Q-TOF), chromatographic retention characteristic and toxicity prediction showed that tricyclazole, propiconazole, hexaconazole, tebuconazole, flutriafol and 2-Amino-4-methylbenzothiazole were key toxicants. The contributions to total toxicity unit (TU) were20.84%, 4.43%, 5.08%, 1.52%, 0.33% and 2.82%, respectively. Specific bacteria and activated carbon adsorption process were proposed for the water treatment plant and the key toxicants were almost removed by the new treatment process to less than 20 μg/L. The effluent showed no detectable toxicity to *Daphnia magna.* EDA can be used for the design and improvement of waste water treatment plant and further benefit the reduction of specific pollutants.

Abstract

From Source to Outcome Pathway: A Role of Environmental "-omics" in Environmental Science

Xiaowei Zhang

State Key laboratory of Pollution Control and Resource Reuse, Nanjing University

Corresponding author e-mail: zhangxw@nju.edu.cn

Recent development of environmental "-omics" has significantly approved its values in assessing the effects of contaminants on individual species and the whole community. Studies commonly look at virtually all DNA (genomics), RNA (transcriptomics), proteins (proteomics) or metabolites (metabolomics) in congress to study the molecular mechanisms of toxicity caused by chemicals. High-throughput genomics can also provide access to rapid, dynamic information on the deep structure of eco communities. Metagenomics of macro-biome provide utilities to unveil those areas of 'dark diversity' that until now have proved resistant to practical observation, while the integration of metatranscritomics provides an exciting prospect of linking these structural observations to broad-scale observations of function at the assemblage level. These emerging methodologies using genome enabled approaches provides the opportunity to examine effects and mechanisms of chemicals in individual species and the whole community compositional from both prospective and retrospective manners. Recent development and application of the -omics approaches in ecotoxicology and ecology will be presented. Especially, how to integrate of results of environmental omics to support science-based policy for ecosystem management will be discussed.

Keyword: risk assessment, ecotoxicity, hazard assessment, in vitro assay, ecosystem service, biodiversity

Abstract

The toxic effects of deltamethrin and fenvalerante in soil identified by a multi-endpoint study using earthworm (*Eisenia fetida*) as the test species

Yufang Song, Xiuying Li[1], Jun Yan[1]

Key Laboratory of Pollution Ecology and Environmental Engineering, Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang 110016

Deltamethrin and fenvaleranteare harmful pyrethroid ester pesticides. The toxic effects of deltamethrin and fenvalerante were evaluatedusingthe earthworm *Eisenia fetida* as a model organism in a multi-endpoint study.The acute toxic effects were evaluated by exposing earthworms to deltamethrin or fenvalerantein either moist filter paper or/and soil for 14 days. The cytotoxicitytest was conductedby exposing earthwormsto deltamethrin or fenvaleranteinsoil for 56 days followed by chronic toxicity test for 28 days, respectively.

Acute toxic test results showed that the earthworm survival rate decreased at elevated deltamethrin or fenvalerate concentration in both filter paper test and soil tests. Therefore, both deltamethrin and fenvalerate were classified as highly toxic pesticides, and the toxicity of fenvaleratewas estimated about 1000 times higher than that of deltamethrin, however, the soil contact test identified that both deltamethrin and fenvalerateare among the pyrethroidsin type compounds with low toxicological effects. Our results indicated that deltamethrin and fenvalerateat low concentrations could pose a significant reproductive toxicity on worms in term the inhabitation to cocoon and larva emerging. The CYP3A4 enzyme activity responded significantly to deltamethrin and fenvalerante in soil at low concentration levels. Furthermore, a negative correlation between the increase of toxicity response of worms and decrease of the concentration with time indicated that more toxic metabolites may exist. This study providedan insight into the toxicological profile of pyrethroids, which may lead toa better risk assessment of eltamethrin and fenvalerante in soil.

Keywords: Pyrethroids; Soil; Toxic response; Multi-endpoints; Risk assessment

Abstract

Evaluation of five microbial and four mitochondrial DNA markers for tracking human and pig fecal pollution in freshwater

Xiwei He[1], Xuxiang Zhang[1*], Guolu Zheng[2], Huimei Chen[3*], Peng Liu[1], Wei Shi[1], Yibin Cui[1], Hongqiang Ren[1]

[1]State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, China.
[2]College of Agriculture, Environmental and Human Sciences, Lincoln University, Missouri, USA
[3]Jiangsu Key Laboratory of Molecular Medicine, School of Medicine, Nanjing University, China

This study firstly and systematically evaluated the performances of five microbial and four mitochondrial DNA (mtDNA) markers, based on their sensitivities, specificities, fecal abundances, and decay rates in freshwater of both laboratory and field settings. The microbial DNA markers were the three human-associated (H-Bac 1 and HF183 of *Bacteroidales* and B.adolescentis of *Bifidobacterium*) and the two pig-associated (Pig-2-Bac of *Bacteroidales* and L.amylovorus of *Lactobacillus*), while the mtDNA ones were the two human- (H-ND6 and H-ND5) and the two pig-associated (P-CytB and P-ND5). All the mtDNA markers showed a higher sensitivity (100%) than the microbial ones (84.0-88.8%) except Pig-2-Bac (100%). Specificities of the human mtDNA markers (99.1 and 98.1%) were higher than those of the human-associated microbial ones (57.0-88.8%), but this pattern was not observed for the pig mtDNA markers (68.2 and 84.1%) vs. the pig-associated microbial ones (74.8 and 100%) where Pig-2-Bac had 100% specificity. The relatively low specificities of P-CytB and P-ND5 might have been due to the cross reactions of their PCR primers with mtDNAs of non-pig host species, dog, in particular. The reliability of H-ND6 and H-ND5 was further evidenced in their performances to identify locations of the most polluted within the Taihu Lake watershed of China. In general, the microbial DNA markers demonstrated a higher mean fecal abundance than the mtDNA ones; increasing temperature and sunlight exposure accelerated significantly the decay of all the DNA markers, but the *Bifidobacterium*- and *Lactobacillus*-origin ones appeared to be relatively stable. Results of this study suggest that DNA markers H-ND6, H-ND5, and Pig-2-Bac may be among the best for fecal source tracking in freshwater.

Abstract

Influences of high-fat diet on arsenic hepatotoxicity in mice

Hui Hou, Su Liu*, Xuechao Guo, Haiyan Yu, Bing Wu*, Xu-xiang Zhang, Yibin Cui

State key lab of pollutant control and resource reuse, School of the Environment, Nanjing University, Nanjing, 210023, P.R. China

*Corresponding author e-mail: bwu@nju.edu.cn

Chronic exposure to inorganic arsenic (iAs) or a high-fat diet (HFD) can produce liver injury. However, the effects of HFD on risk assessment of iAs in drinking water are unclear. In this study, we examined how HFD and iAs interact to alter iAs-induced liver injury in C57BL/6 mice. Mice fed low-fat diet (LFD) or HFD were exposed to 3 mg/L iAs or deionized water for 10 weeks. Results showed that HFD changed intake and excretion of iAs by mice. Then, HFD increased the amount of iAs-induced hepatic DNA damage and amplified changes in pathways related to cell death and growth, signal transduction, lipid metabolism and insulin signaling. Compared to gene expression profiles caused by iAs alone or HFD alone, insulin signaling pathway might play important roles in the interactive effects of iAs and HFD. Our data suggest that HFD increases sensitivity of mice to iAs in drinking water, resulting in increased hepatotoxicity. This study highlight that HFD might enhance the risk of arsenic hepatotoxicity in arsenic-polluted regions. The diet should be considered during risk assessment of iAs in drinking water.

Abstract

Metagenomic Profiles of ARGs in PM2.5 and PM10 Pollutants during a Severe Smog Event

Jialin Hu, Fuzheng Zhao, Kan Li, Chaoran Li, Lin Ye, Mei Li, Xu-Xiang Zhang*

State Key Laboratory of Pollution Control and Resource Reuse, Environmental Health Research Center, School of the Environment, Nanjing University, Nanjing, China

Currently, the misuse and overuse of antibiotics in disease treatment and livestock farming promote antibiotic resistance in bacteria and hinder diseases treatment. Nowadays, studies of air pollution are focused on the pollutants' physical and chemical properties, little information is available on distribution characteristics of bio-pollutants, such as antibiotic resistance genes (ARGs) carried by airborne microbes during a smog event. This study characterized the distribution profile of ARGs in the particulate matter (PM) samples during a severe smog by analyzing metagenome sequencing datasets of airborne microorganisms. A total of 205 ARG subtypes were detected in the PM samples, including 31 dominant ARG subtypes encoding 11 types of ARGs. Among the detectable ARGs, Tetracycline, β-lactam and aminoglycoside resistance genes had the highest abundance. Our results revealed that severe smog can increase the abundance of airborne ARGs, which may pose health risks to the public exposed to long-term air pollution. ARGs profiles in smog air can be heavily influenced by the interaction of bacterial community, physicochemical factors and meteorological parameters. The characteristics of ARGs distribution in PM during smog days were distinct from other environments, but were similar to the soil. The results may help to understand the general distribution characteristics of airborne ARGs during a severe smog period and provide a reference for the assessment of the impact of smog and haze.

Abstract

Free-living bacteria and potential bacterial pathogens in sewage treatment plants

Kailong Huang[1,2], Yanping Mao[1], Fuzheng Zhao[2], Xu-Xiang Zhang[2], Feng Ju[1], Lin Ye[2], Yulin Wang[1], Bing Li[1], Hongqiang Ren[2]*, Tong Zhang[1,2]*

[1]*Environmental Biotechnology Lab, Department of Civil Engineering, The University of Hong Kong, Hong Kong SAR, China*
[2]*State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, China*

To comprehensively understand the profile of free-living bacteria and potential bacterial pathogens in sewage treatment plants (STPs), this study applied high-throughput sequencing-based metagenomics approaches to investigate the effects of activated sludge (AS) treatment process and ultraviolet (UV) disinfection on the bacterial community in two full-scale STPs. A total of 23 bacterial genera were identified as free-living bacteria in this study, and 243 species were identified as potential bacterial pathogens, 6 of which were confidently detected in STPs (with the total abundances ranging from 0.0029% to 3.18%). Both diversity and relative abundance of the detected bacterial pathogens decreased obviously after AS treatment process, and increased slightly after sedimentation. The relative abundance of both UV-resistant bacteria (e.g. *P. aeruginosa*) and pathogenic bacteria increased after UV disinfection. Although large amounts of the pathogens were eliminated through the sewage treatment process, the STPs could not effectively remove the free-living bacterial pathogens. Some pathogenic bacteria (e.g. *P. aeruginosa*) present in the effluent showed a slight increase in relative abundance after UV disinfection. Overall, the results extend our knowledge regarding the community of potential pathogens in STPs and shed new lights on the effects of AS process and UV disinfection on the bacterial pathogens in STPs.

Abstract

Bacterial community shift drives antibiotic resistance promotion during drinking water chlorination

Shuyu Jia [1], Peng Shi [1*], Qing Hu [1], Bing Li [2], Tong Zhang [2], Xu-Xiang Zhang [1*]

[1] *School of the Environment, Nanjing University, Nanjing 210023, China.*
[2] *Department of Civil Engineering, The University of Hong Kong, Hong Kong SAR, China.*

A variety of antibiotic resistance genes (ARGs) occur in drinking water around the world. Chlorination can elevate the total relative abundance of ARGs and individual ARGs shows highly variable responses to the chlorine stress. However, universal changing patterns of ARGs during chlorination have not been fully explored to date. Chlorination can alter bacterial community structure in drinking water, but the contribution of the bacterial community shift to the resistome alteration still remains unclear.

For comprehensive insights into the effects of chlorination, a widely used disinfection technology, on bacterial community and antibiotic resistome in drinking water, this study applied high-throughput sequencing and metagenomic approaches to investigate the changing patterns of antibiotic resistance genes (ARGs) and bacterial community in a drinking water treatment and distribution system.

At genus level, chlorination could effectively remove *Methylophilus*, *Methylotenera*, *Limnobacter* and *Polynucleobacter*, while increase the relative abundance of *Pseudomonas*, *Acidovorax*, *Sphingomonas*, *Pleomonas* and *Undibacterium* in the drinking water. A total of 151 ARGs within 15 types were detectable in the drinking water, and chlorination evidently increased their total relative abundance while reduced their diversity in the opportunistic bacteria ($p < 0.05$). Residual chlorine was identified as the key factor driving the bacterial community shift and resistome alteration. As the dominant persistent ARGs in the treatment and distribution system, multidrug resistance genes (mainly encoding resistance-nodulation-cell division transportation system) and bacitrac in resistance gene *bac*A were mainly carried by chlorine-resistant bacteria *Pseudomonas* and *Acidovorax*, which mainly contributed to the ARGs abundance increase. The strong correlation between bacterial community shift and antibiotic resistome alteration observed in this study reveals that chlorination can alter antibiotic resistome in drinking water via bacterial community shift.

Abstract

The impact of high salinity on bacterial community composition and antibiotic resistance genes in wastewater treatment

Meitian Liu, Xuxiang Zhang, Lin Ye, Hongqiang Ren

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, China.

This study investigated the impact of high salinity and different salt on bacterial community composition and antibiotic resistance genes in activated sludge treating industrial wastewater. For this purpose, three laboratory-scale sequencing batch reactors were operated with activated sludge as inoculum. The influent contains 500 mg COD/L, 60 mg N/L of ammonia, different concentrations of salt (NaCl and Na_2SO_4) and other nutrients. The microbial communities were analyzed by Illumina MiSeq sequencing of 16S rRNA gene amplicons. Reactor performance results showed that high salinity significantly inhibited the efficiency of biological treatment and led to the changes of microbial community. Statistical analysis was used to investigate the associations between the microbial community structure and the different salinity environments. Principal coordinate analysis (PCoA) results revealed significantly different community structures in the three reactors.

Abstract

Different impacts of manure and chemical fertilizers on bacterial community structure and antibiotic resistance genes in arable soils

Peng Liu, Shuyu Jia, Xiwei He, Lin Ye, Xuxiang Zhang

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023,China

Both manure and chemical fertilizers are widely used in modern agriculture. However, the impacts of different fertilizers on bacterial community structure and antibiotic resistance genes (ARGs) in arable soils still remain unclear. In this study, high-throughput sequencing and quantitative PCR were employed to investigate the bacterial community structure, ARGs and mobile genetic elements (MGEs) influenced by the application of different fertilizers, including inorganic chemical fertilizers, piggery manure and straw ash. The application of fertilizers could significantly change the soil bacterial community and the abundance of *Gaiella* under phylum Actinobacteria was significantly reduced from 12.9% in unfertilized soil to 4.1%-7.4% in fertilized soil ($P<0.05$). The application of manure could cause a transient effect on soil resistome composition and the total abundance of ARGs increased from 7.37 ppm to 32.10 ppm. The abundance of aminoglycoside, sulfonamide and tetracycline resistance genes greatly increased after manure fertilization and then gradually returned to normal levels with the decay of some intestinal bacteria carrying ARGs. Our study set forth the mechanism by which the fertilizer application influences the soil resistome composition and may shed light on further study.

Abstract

Low-levels of graphene inhibit cellular xenobiotic defense system mediated by efflux transporters

Su Liu[1], Wei Jiang[1], Bing Wu[1,2,*], Jing Yu[1], Haiyan Yu[1], Xu-Xiang Zhang[1], Cristina Torres-Duarte[2], Gary N. Cherr[2,3,*]

[1]*State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing, 210023, P.R. China*
[2] *Bodega Marine Laboratory, University of California, Davis, California, USA*
[3]*Departments of Environmental Toxicology and Nutrition, University of California, Davis, California, USA*

Dose is one of the most important factors of nanomaterial (NM) toxicity. Low levels of NMs are considered to be safe. In this study, we analyzed the potential toxicity of graphene at relatively low concentration on plasma membrane ABC transporter activity of Human cell line HepG2. In the cell membrane, ABC transporters are common and are known to play a crucial role in multidrug resistance (MDR), where they function as efflux pumps and are responsible for chemotherapeutic drug resistance in cancer cells. ABC transporters can also pump xenobiotics out of the cell using an ATP-dependent mechanism, thus reducing potential toxic effects. The results showed that graphene (<0.5 μg/mL) did not decrease cell viability, generate reactive oxygen species (ROS) and cause cell apoptosis. However, graphene at non-toxic concentration could increase Calcein-AM (CAM, an indicator of membrane ABC transporter activities) accumulation, indicating inhibition of ABC transporters' activities. This inhibition could be observed even at 0.005μg/mL, which is 100-times and lower than its lowest toxic concentration from cytotoxicity experiments. The inhibition of ABC transporters significantly sensitized the toxicity of paraquat, a toxic and widely used herbicide and a known substrate of ABC transporters. The potential mechanism of inhibition of membrane transporter activities caused by graphene was further analyzed by gene expression, protein expression and membrane integrity and function. Based on above results, we assume that graphene can damage cell membrane functions, and thus causing an inhibition of potentially all plasma membrane transporter (P-gp/MRP/BCRP) activity. This study shows the amplification of environmental effects of graphene at non-toxic concentrations, which could significantly cause the inhibition of ABC transporters' activities.

Abstract

Start-up of the simultaneous anammox and denitrification process with different initial sludge: performance and microbial community dynamics

Depeng Wang, Ye Lin, Xu-Xiang Zhang*

State Key Laboratory of Pollution Control and Resource Reuse, Environmental Health Research Center, School of the Environment, Nanjing University, Nanjing 210023, China

The anaerobic ammonium oxidation (anammox) bacteria has the unique ability to combine ammonium and nitrite to form N_2, but this process usually has the by-product of nitrate. In order to effectively remove nitrate, the simultaneous anammox and denitrification process with different initial sludge was investigated. Results showed that desirable performance was achieved with average NH_4^+-N, NO_2^--N and TN removal efficiencies of 96.4%, 98.7% and 90.5%, respectively. However, in the process of start-up anammox, R2 reactor with activated sludge accumulated anammox bacteria more easily. This was also demonstrated by microbial community structure and functional gene analysis. Cluster analysis revealed that, although initial sludge was different, the microbial community structure of R1 and R2 reactor have high similarity at finally. Particularly, in the process of microbial community structure shifts, Chloroflexi and Proteobacteria played a pivotal role in R1 reactor, whereas in R2 reactor that was Proteobacteria. These finding indicated that the concurrence of anammox and denitrification process were able to removal ammonium, nitrite and nitrate simultaneously.

Abstract

Impact of Zinc Cation and Its Nanoparticles on Physiological Activity and Transcriptional of Nitrifying Bacteria

Qiang Wu, Xuxiang Zhang, Lin Ye

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, China

Zinc is an essential element of life activity. However, excess zinc can inhibit nitrification, a key process for nitrogen removal in wastewater treatment. With the increasing application of nanomaterials, zinc nanoparticles (Zn NPs) and zinc oxide nanoparticles (ZnO NPs) have been reported to induce adverse effects on plants and human health. Nevertheless, the comparative impacts of zinc cation, Zn NPs and ZnO NPs on nitrifying bacteria are unknown. In this study, short-term exposure experiments were conducted. There was significant decrease in ammonia nitrogen removal rate and SOUR with increasing concentrations of the three materials. Low concentration of zinc cation (0.1mg/L) promoted the SOUR of nitrifying bacteria, while the high concentration of zinc cation cause the serious inhibition rate of physiological activity. Based on RT-qPCR, there was a strong correlation between amoA expression and SOUR-based inhibition for samples exposed to varying concentrations of zinc cation, Zn NPs and ZnO NPs, suggesting a direct association between amoA expression and physiological activity in these samples. However, transcriptions of hao and nxrA were not in accordance with physiological activity. Additionally, it was found that AOB were more sensitive than NOB to the disturbance of external environmental.

Abstract

Potential toxicity effects and risk assessment of Dechlorine Plus

Yang Yang, Mei Li*, Yibin Cui

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, PR China

Dechlorane Plus (DP), a chlorinated flame retardant, has been widely detected in environmental matrices. DP has characteristics similar to persistent organic pollutants. However, the toxicity data is stilllimited and cannot provide a comprehensive environmental ecological risk assessment for DP. Different testing organisms were chosen toinvestigate the toxicity effects and risk assessment of DP. For *luminous bacteria*, the relative luminosities were around 100% in treated groups, which suggestedthat there is no acute toxicity to luminous bacteria under the studied DP concentrations. The micronucleustest using *Vicia faba* showed no significant difference between treatment and control groups, indicating nogenotoxicity of DP. However the comet assay conducted with *T etrahymena thermophila* was relatively sensitive asthere was a significant increase in DNA damage when the concentrations of DP increased from 300 to1500 μg L^{-1}, while the lower concentrations failed to show any treatment-related differences. Therefore,DP may pose a potential risk at concentration ≥ 300μg L^{-1}. Moreover, short term and long term toxicity of earthworms *Eisenia fetida* were tested on day 7, day 14 andday 28 exposure respectively. Lethality, oxidative stress and damage, neurotoxicity,and transcriptomic profiles were assessed. Results showedthat the acute toxicity of DP was very low. However, DP exposure induced an increase in the oxidativestress markers malonaldehyde (MDA) and 8-Hydroxy-2'-deoxyguanosine (8-OHdG), and altered acetyl-cholinesterase (AChE) activities. High throughput sequencing-based transcriptomic analysis showed thatDP exposure significantly altered gene expression and pathways related to antioxidant enzymes, stressresponses, neurological dysfunctions, calcium binding, and signal transduction. The results from differenttoxicological endpoints indicate that DP toxicity on the earthworm is primarily through oxidative damageand neurotoxicity. Based on these results, we deduce thatoxidative stress and neurotoxicity might be the primary mechanisms of DP toxicity. This study provides scientific information and insight onto the ecological risk assessment of DP.

Abstract

Identifying Health Effects of Exposure to Halonitromethanes by Metabonomics in Mice

Jinbao Yin, Bing Wu, Qiming Xian, Xu-Xiang Zhang

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing, 210023, P.R. China

Halonitromethanes (HNMs), one class of nitrogenbased disinfection byproducts (N-DBPs) of health concern in drinking water, have aroused considerable public concern due to their high cytotoxicity and genotoxicity. The objective of this research was to evaluate the in vivo toxicity of three HNMs in mice. And hepatic oxidative stress and metabolomics responses in mice corresponding to HNMs exposure were investigated. Exposure to the HNMs increased the activities glutathione peroxidase (GSH-Px) and the level of 8-hydroxy-2-deoxyguanosine (8-OHdG), indicating that each exposure generated oxidative stress in mice liver. In addition, metabolomics alterations were also found in mice treated with each of the HNMs. With the increase of HNMs dose, the number of the significantly altered metabolites (SAMs) offered upgrade firstly than descending latter tendency. Furthermore, the alterations of pathways related to amino acid metabolism, energy metabolism and lipid metabolism were identified based on SAMs. We speculated three HNMs might share a common toxicity mechanism on mouse liver, that HNMs could react with host metabolites by dehalogenation, and increase the oxidative stress, which were disturbed the metabolomics. In this study, metabolomic methods were proved to be helpful to provide comprehensive views for the toxic effects of HNMs.

Abstract

Toxicity evaluation of twelve wastewater samples for exploring the difference and relevance between a series of toxicity indexes

YueYu, BingWu*, Su Liu, Zhuoyan Shen, Xuxiang Zhang

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, China.

Experimental studies demonstrated that industrial wastewater usually be toxic for life. More and more studies that researched industrial wastewater have appeared. In our studies, we performed a series of toxicity tests with twelve samples obtained from twelve different industrial parks. Many indexes, such as cell viability, the generation of ROS, the change in mitochondrial membrane potentia, the inhibition of ABC transporter activity and so on, were determined. Samples were diluted to the concentration of 0.02%, 0.2%, 1% and 2% with DMEM. After 24h of growth, the HepG2 cells were exposed to twelve samples for 24 h, which were used for further analyses. After the analysis of these indexs, we have found some difference or consistence between them. our results even showed that the effective concentrations on ROS generation were usually consistent with those found to impact cell viability. We also found that many samples exposure induced mitochondrial depolarization, indicating potential cell apoptosis. However, there was a little difference between the results of cell viability and luminescent bacteria test. It may be caused by the specific differences between HepG2 cells and luminescent bacteria. Additionally, we explored the factors which may affect the toxic level of industrial wastewater through the cluster analysis and crosswise compare of these twelve samples. We have found that the discrepancy of cytotoxicity indexes between twelve samples mainly determined by the ratio of industrial wastewater and the main substance in inlet water.

Abstract

Effect of Low Temperature on Highly Unsaturated Fatty Acid Biosynthesis in Activated Sludge

He Su, Li-li Ding,Ke Xu, Jin-ju Geng, Hong-qiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University

My study belongs to the section of biological waste treatment. Low temperature (< 15 ^{o}C) can result in microbial activity decrease of activated sludge. Improving the activity of activated sludge microorganism under low temperature is important for the wastewater treatment in the North of China. There are many methods have been used to enhance the treatment effect of activated sludge under low temperature, such as changing operation process, adjusting operation parameters, substrate regulation, physical enhancement, adding additives and adding high psychrotrophic bacteria. Phospholipid fatty acid (PLFA) composition of cell membrane and microbial community structure are very important for activated sludge microorganism to adopt cold environment. Phospholipid fatty acid (PLFA) extraction and high-throughoutput sequencing (HiSeq) were applied to activated sludge system at 2012, which makes it possible to confirm the highly Unsaturated Fatty Acid (UFA) metabolic pathways change at low temperature. The result showed 43.11% of phospholipid fatty acid (PLFA) in the activated sludge participated in UFA biosynthesis, and γ-Linolenic could be converted to Arachidonic acid at low temperature. The highly UFA biosynthesis in activated sludge was n-6 highly UFA biosynthesis, rather than n-3 highly UFA biosynthesis. The microbial community structures of activated sludge were analyzed by PLFA and high-throughput sequencing (HiSeq) simultaneously. *Acidovorax, Pseudomonas, Flavobacterium* and *Polaromonas* occupied higher percentage at 5 °C, and genetic changes of highly UFA biosynthesis derived from microbial community.

Abstract

Concentration, composition, bioavailability, and *N*-nitrosodimethylamine formation potential of particulate and dissolved organic nitrogen in wastewater effluents: a comparative study

Haidong Hu, Haijun Ma, Lili Ding, Jinju Geng, Ke Xu, Hui Huang, Yingying Zhang, Hongqiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of theEnvironment, Nanjing University, Nanjing 210023, Jiangsu, PR China

Wastewater-derived organic nitrogen (org-N) can act as both nutrients and carcinogenic nitrogenous disinfection byproduct precursors. In this study, the concentration, composition, bioavailability, and N-nitrosodimethylamine (NDMA) formation potential of particulate organic nitrogen (PON) from three different municipal wastewater treatment plants were characterized and compared with that of effluent dissolved organic nitrogen (DON). The average effluent PON and DON concentrations ranged from 0.09 to 0.55 mg N/L and from 0.91 to 1.88 mg N/L, respectively. According to principal component analysis, org-N composition and characterization differed in PON and DON samples ($n = 20$). Compared with DON, PON tended to be enriched in protein and nucleic acids, and showed a more proteinaceous character. Composition of org-N functional groups estimated from the X-ray photoelectron spectroscopy N 1s spectra indicate no significant differences in the molecular weight distribution of the protein-like materials between PON and DON. Moreover, PON exhibited a significantly higher bioavailability (61.0 ± 13.3%) compared to DON (38.5 ± 12.4%, $p < 0.05$, t-test) and a significantly higher NDMA yields (791.4 ± 404.0 ng/mg-N) compared to DON (374.8 ± 62.5 ng/mg-N, $p < 0.05$, t-test). Accordingly, PON contributed to approximately 12.3–41.7% of the total bioavailable org-N and 22.0–38.4% of the total NDMA precursors in wastewater effluents. Thus, the potential adverse effects of PON on wastewater discharge and reuse applications should not be overlooked, even though it only accounted for 7.4–26.8% of the total effluent org-N.

Abstract

Core bacterial community in a two-stage full-scale anaerobic reactor treating high-strength pharmaceutical wastewater

Haijun Ma, Lin Ye, Haidong Hu, Lulu Zhang, Lili Ding, Hongqiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

Although the anaerobic digestion (AD) has been successfully applied for wastewater treatment around the world, the core bacterial microbes involved in AD process has not been well characterized. Here in this study, using Miseq sequencing technology, the core bacterial community of 98 operational taxonomic units (OTUs) was determined in a two-stage upflow blanket filter (UBF) reactors which treated high-strength pharmaceutical wastewater and underwent two perturbations during the monitoring period. The 98 core bacterial OTUs accounted for 61.84% of the total sequences and accurately predicted the sample location in the principal coordinates analysis (PCoA) biplot as the total bacterial OTUs did. The core bacterial community in the first-stage (FS) and second-stage (SS) reactors were generally distinct. Bacteroidetes was far more abundant in FS core community while Proteobacteria, Chloroflexi and Synergistetes were more abundant in SS reactor, indicating that the FS core bacterial community was more related to higher-level fermentation process and SS core bacterial community contained more microbes in syntrophic cooperation with methanogens. The core community in FS and SS reactors showed different response to the two perturbations during the monitoring period. Co-occurring analysis at the order level demonstrated that Bacteroidales and Selenomonadales were probably functionally independent whereas Anaerolineales, Syneristales and Thermotogales may accomplish degradation of pollutants through tight syntrophic cooperation with other microbes. However, once the anaerobic sludge started to accumulate in FS reactor, the core bacterial community at the bottom of FS and SS reactors shifted to be similar to each other, perhaps because the system was not operated for separating acidogenic and methanogenic process. These findings advanced deeper insight into the metabolic mechanism of anaerobic bacteria for future improvement of microbial management of two-stage anaerobic system.

Abstract

Development of an extraction method and LC-MS analysis for N-acylated-L-homoserine lactones (AHLs) in wastewater treatment biofilms

Jinfeng Wang, Lili Ding, Hongqiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

N-acylated-L-homoserine lactones (AHLs) play a vital role in Gram-negative bacteria communication by promoting the formation of extracellular polymeric substances (EPS) and biofilms. However, the low concentration of these AHL signals makes the process difficult to understand. A robust and sensitive pretreatment method for AHL detection was developed in this work. Compared with eight different solid-phase extraction (SPE) columns and three various solid extraction method, we found that the UE (ultrasonic extraction) and an Oasis hydrophilic-lipophilic-balanced (HLB) sorbent in column format combined with ultra-performance liquid chromatography linked to tandem mass spectrometry (UPLC-MS/MS) can be successfully used for systematic pretreating moving bed biofilm reactor (MBBR) biological samples to extract AHLs and determine concentration of AHLs in wastewater treatment biofilms. This easy-to-follow protocol makes it ideal for quantitative analyses of AHLs in wastewater treatment biofilms.

Abstract

Degradation characteristics and metabolic pathway of 17β-estradiol by Rhodococcus sp. DS201

Qingmiao Yu, Ping Wang, Dan Wang, Hongliang Huo*

In this study a 17β-estradiol-degrading bacterium was isolated from the activated sludge of the municipal treatment plant of a contraceptive medicine processing factory in Beijing, China. Using the observed morphological and physiological features of the bacterium and 16S rDNA sequence analysis, this bacterial strain was identified as *Rhodococcus sp. DS201*. Using single-factor experimentations and orthogonal tests, it was demonstrated that when strain DS210 bacteria were inoculated into MM medium with an initial pH7 and inoculum amount of 1%, complete degradation of E2 by this strain was achieved within 3 days when the medium was maintainedat 30°C and an initial concentration of 1 mg/L. After strain DS201 degraded the 17β-estradiol, several 17β-estradiol metabolites were detected in the culture extracts using high-performance liquid chromatography (HPLC); they were then further identified using HPLC with tandem mass spectrometry. Mass spectrum analysis of the E2 degradation identified the following products:pent-4-enoic acid; 2-ethyl-3-hydroxy-6-methylcyclohexane-1-carboxylic acid; 3-(7a-methyl-1,5-dioxooctahydro-1H-inden-4-yl) propanoicacid; 5-hydroxy-4-(3-hydroxypropyl)-7a-methyloctahydro-1H-inden-1-one. These products have not yet been reported as parts of a mechanism for microbial E2 degradation and were suspected to be new metabolite products. Therefore, the E2 degradation pathway by strain DS201 is proposed herein.

Keywords: 17β-estradiol; biodegradation; *Rhodococcus sp*; degradation pathway

Abstract

Oxidative Coupling of Acetaminophen Mediatedby Fe^{3+}-Saturated Montmorillonite

Peng Anping, Gu Cheng

School of the Environment, Nanjing University, Nanjing, China

Acetaminophen (APAP) is an antipyretic and analgesic ingredients used in many over-the-counter and prescription medicines. Nowadays APAP has been frequently detected in surface water, groundwater, and soils with the concentrations from ppt to ppm levels. Once released into the soil environment, APAP would interact with different soil particles and these abiotic/biotic processes could significantly affect the bioavailability and toxicity of APAP. So far it still lacks enough information about the transformation of APAP mediating by different environmental processes in soil. Clay minerals are important soil particles; studies have shown that clay minerals with the unique structure can strongly sequestrate and transform many organic contaminants. Researchers have indicated that when the interlayer of montmorillonite was exchanged with transition metal cations(e.g. Cu^{2+}, Fe^{3+}), it can catalyze the degradation or polymerization of aromatic pollutants and most of them were conduct under relative low moisture conditions, it is still not clear whether the similar reaction can also occur in the aqueous solution. In this work, Fe^{3+}-montmorillonite was prepared and mixed with APAP in aqueous solution, the transformation kinetic, degradation mechanism and reaction pathway of APAP in the presence of natural phenolic acids were systematically investigated. Results indicated that the high catalytic activity of Fe^{3+}-montmorillonite for oxidative coupling of APAP was attributed not only to the interlayer Fe^{3+}, but also to the Fe^{3+} adsorbed on the external surface of clay minerals. The cross-coupling reaction between APAP and ubiquitous phenolic acids lead to the formation of higher degree of oligomers, and the competition for the reactive sites between APAP and phenolic acids was also observed. The results from current study demonstrated the importance of transition metal saturated clay minerals for the abiotic transformation of anthropogenic micropollutants.

Photo-demethylation of methylmercury by natural soil particles: factors and

Abstract

mechanistic insights

Sheng Feng[1], GuCheng [1],ZhongHuan[1]

[1]State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing, 210023, P. R. China

Among mercury (Hg) compounds, methylmercury (MMHg) is considered to be the most potent toxicity that has the ability to bioaccumulate and biomagnify in aquatic food webs. Therefore, degradation of MMHg plays a significant role in biogeochemical cycling of Hg in aquatic ecosystems. Most previous studies demonstrated that photo-demethylationis major pathway of MMHg in surface water, and dissolvedorganic matter (DOM) is expected to play a critical role in homogenous systems. Meanwhile, direct illumination and reactive oxygen species (ROS, as ·OH, $^{3}DOM^{*}$, $^{1}O_2$ and e_{aq}^{-}) from DOM are probably responsible for photo-demethylation of MMHg in natural waters. However, effect of soil particle in surface water on photo-demethylation of MMHg has been rarely concerned. Since MMHg accumulated on soil particles are obviously more than in homogenous water, we proposed indirected photolysis with soil particles may be involved in surface aqueous systems. Here effect of types of fifteen soil samples including red soil, yellow soil and chernozem, and roles of different ROS in MMHg photo-demethylation were both investigated. In this work, photo-demethylation reaction of MMHg was conducted with artificial sunlight irradiationin fifteen soil suspensions. Results indicatephoto-degradation of MMHg can be effectively facilitated by soil particles. Comparing the pseudo first order kinetic constant (K) of MMHg with parameters of soil basic properties, rate of MMHg photo-degradation is principally proportion to soil organic matter (SOM) and soil iron (Fe). The mechanism of photo-demethylation of MMHg with soil particles is attributed to singlet oxygen as main radical which is demonstrated by scavenger experiments. Our study demonstrates a new pathway of MMHg degradation by soil particles via aquatic photochemistry and important role of singlet oxygen in aqueous systems.

Abstract

Natural formation of dioxin-like compounds on the surface of Fe(III) contained smectites

Yi Wang, Cheng Gu*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, P.R. China

Our previous studies demonstrated that OCDD and some predioxins can be formed from CPs on the surface of Fe(III)-montmorillonite at low RHs (<18%) and room temperature. The reaction is initiated by single electron from the CPs to Fe(III), followed by dimerization, dechlorination, and ring closure, which provided the first direct evidence for the hypothesis of PCDD/Fs *in situ* formation. However, neither Fe(III)-saturated montmorillonite nor the low RHs is common in environment. Here we report the formation of a predioxin4,6-dichloro-2-(2,4,6-tricholorophenoxy) and 2,6-dichloro-4-(2,4,6-trichlorophenoxy), both are HO-PCDEs, from the reaction of 2,4,6-TCP with much more common Fe(III) contained smectites, i.e., SWy-2, NAu-1, and NAu-2, with RH ranged from 6% to 80%. The results turned out that the reaction of NAu-2 with 2,4,6-TCP was higher than that of SWy-2 and NAu-1, and is inhibited with RH increasing; in contrast, little products yields were detected under low RH in the systems of SWy-2 and NAu-1, and the reaction is enhanced as the RH increased to a certain RH. O_2 is in favor of the reaction between 2,4,6-TCP and clay minerals. Since O_2 would oxidize the generated Fe(II) and thus promote the reaction. In view of the abundance of CPs and Fe-contained smectites in environment, the conversion of CPs by these clays may play a center role in the natural production of HO-PCDEs and PCDD/Fs.

Abstract

Degradation of atrazine by hydroxyl radicals promoted by natural montmorillonite

Lin Zhang, Cheng Gu

School of the environment, Nanjing University, Nanjing, Jiangsu, China

Atrazineis an effective agricultural herbicide which is widely used throughout the world. Because of its persistence and biological accumulation, it is of great significance for scientists to study its environmental behavior and pathway for degradation.

Indole-3-acetic acid is an essential phytohormone widely detected in the environment. Under ultraviolet irradiation, the photoionization of IAA will generatearomatic radical cations and hydrated electrons. The lifetime of eaq- in solution is short and will be transformed to hydroxyl radicals in the presence of oxygen.
Smectites, including montmorillonite, are 2:1 layered aluminosilicate clay minerals that are widely distributed. The unique structure ofsmectites could induce the formation of organic radical cations and then localize these radicals in the interlayer regions.Here, we hypothesize that the presence of montmorillonite enhances the production of eaq- by facilitating the separation of electrons and radical cations during the light irradiation of IAA, and thus more reactive radicals are generated to effectively degrade atrazine adsorbed on clay surfaces.

In this research, the photochemical process is initiated by the adsorption of atrazine and IAA in clay interlayers. We speculated that the degradation of atrazine is attributed to ▪OHandeaq-. This process is influenced by pH conditions. The promotion of montmorillonite is more significant under acidic condition. Furthermore, the adsorption of atrazine as well as IAA onto K+-montmorillonite and Ca2+-montmorillonite has joint effects on the transformation of atrazine. In this case, although Ca2+-montmorillonite shows much higher adsorption of IAA than K+-montmorillonite because of the complexation between Ca2+ and carboxyl group, the adsorption of atrazine onto the two montmorillonites is quite the opposite, and our results indicate that the adsorption of atrazine plays a dominant role. The critical role of montmorillonite in this system, except from enhancing the yield of eaq-, is to provide a unique matrix so that the reaction occurs in the interlayer regions in which case the direct contact between atrazine and reactive radicals will be increased.

Fluidized-bed Fenton coupled with ceramic membrane separation for treatment of flax wastewater

Dong Fan, Lili Ding, Hui Huang, Mengtian Chen, Hongqiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University

Fluidized-bed Fenton was coupled with ceramic membrane separation to treat the flax wastewater. The operating variables, including initial pH, dosage of H2O2 and Fe0, were optimized for a better removal efficiency. Besides, the effect of ceramic membrane was also evaluated. Fluorescence excitation emission matrix-parallel factor analysis (EEM-PARAFAC), apparent molecular weight (AMW) distributions and Fourier transform infrared (FT-IR) spectroscopy were used to analyse the DOMs in detail. Under the optimum condition (600 mg□L-1 H2O2, 1.4 g□L-1 Fe0 and pH =3), the highest removal efficiency of TOC and color were 84% and 94%with 122 mg□L-1leaching iron. Experimental results showed that the ceramic membrane could efficiently intercept catalyst particles (the average particle size> 100nm), macromolecules organic matter (AMW > 20000Da) and hydrophobic humic-like component. EEM-PARAFAC identified four humic-like (M1~M4) and one protein-like components (M5). In the coupled process, the removal efficiency of M1, M2was higher than low molecular weight and microbial-delivered component (M3, M4). The FT-IR spectroscopy also revealed the variation of the characteristic absorbance bands.

Degradation of diclofenac and naproxen in wastewater using UV and

Abstract

UV/persulfate: Kinetics and mixture toxicity

Xingsheng Gao, Jinju Geng*, Hongqiang Ren

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, China

Several studies reported on the limited degradability of pharmaceuticals under conventional treatments applied in the waste water treatment plants, suggesting that their upgrade and implementation of advanced treatment technologies are required to achieve high-quality treated effluents. Diclofenac（DCF）and naproxen (NPX) are widely used analgesic and anti-inflammatory drugs and have been found as pollutants in aqueous environments. Direct UV photolysis and UV/ persulfate（UV/PS）degradation of DCF and NPX in Milli-Q water and wastewater were studied using a 22 W low pressure UV lamp, and the average UV irradiance through the water volume was 1.5 mW/cm2. The initial concentrations of DCF, NPX and PS were 10μM, 10μM and 1 mM, respectively. Under UV photolysis, 80% of DCF degraded in 5 min while the NPX removal was 30% after 50 min. Under UV/PS, the removal of DCF and NPX reached 90% in 5 minutes, suggesting UV/PS process being much more efficient than UV. The kinetics of DCF in secondary effluent was 0.2204 min-1, and the half-life was 3.14 minutes. In Milli-Q water, they were 0.3390 min-1 and 2.04 minutes, suggesting that suspended solids and suspended microorganisms in wastewater decreased the photo degradation of DCF. The toxicity of DCF sample treated by UV onluminous bacteria increased, with 5%, 27%, 33%, 38%, 57% inhibition after 1, 3, 10 and 30 minutes, respectively. DCF, NPX mixture sample treated by UV/PS got higher inhibition at the same period, and they are 13%, 70%, 87%, 100%.These results indicated that DCF, NPX can be effectively removed by UV/PS, whereas some more toxic transformation products than parent compounds yielded.

Abstract

Phosphorus recovery from biogas slurry by ultrasound/H_2O_2 digestion coupled with HFO/biochar adsorption process

Xuemeng He[1], Tao Zhang[1]*, Hongqiang Ren[2], Guoxue Li[1], Lili Ding[2]

[1]*Key Laboratory of Plant-Soil Interactions of Ministry of Education, College of Resources and Environmental Sciences, China Agricultural University, Beijing 100193, China*
[2]*State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210093, Jiangsu, China*

Phosphorus (P) recovery from biogas slurry has recently attracted considerable interest. In this work, ultrasound/H_2O_2 digestion coupled with ferric oxide hydrate/biochar (HFO/biochar) adsorption process was performed to promote P dissolution, release, and recovery from biogas slurry. The results showed that the optimal total phosphorus release efficiency was achieved at an inorganic phosphorus/total phosphorus ratio of 95.0% at pH 4, 1 mL of added H_2O_2, and ultrasonication for 30 min. The P adsorption by the HFO/biochar followed pseudo second-order kinetics and was mainly controlled by chemical processes. The Langmuir-Freundlich model matched the experimental data best for P adsorption by HFO/biochar at 298 and 308 K, whereas the Freundlich model matched best at 318 K. The maximum amount of P adsorbed was 220 mg/g. The process was endothermic, spontaneous, and showed an increase in disorder at the solid-liquid interface. The saturated adsorbed HFO/biochar continually releases P and is most suitable for use in an alkaline environment. The amount of P released reached 29.1 mg/g after five extractions. P mass balance calculation revealed that 11.3% of the total P can be made available.

Impact of selected pharmaceuticals on reactor performance and microbial community in sequencing batch reactors

Abstract

Cong Jiang, Jinju Geng*, Hongqiang Ren

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

The wide uses of non-steroidal anti-inflammatory drugs (NSAIDs) ineluctably add the release into wastewater that might lead to potential negative impacts on wastewater treatment where microorganisms play an important role. To evaluate the impact of environmental concentration NSAIDs on wastewater treatment efficiencies, microbial community and bacterial diversity, three widely detected NSAIDs, diclofenac (DCF), ibuprofen (IBP) and naproxen (NPX), were selected as pollutants in this study, and the exposure experiments with three combinations (5 ug L-1 of DCF, 5 ug L-1 of DCF+5 ug L-1 ofIBP and 5 ug L-1 of DCF+5 ug L-1 of IBP+ 5 ug L-1 of NPX) were operated in sequencing batch reactors (SBRs) for 130 days. Results showed that removals of chemical oxygen demand (COD) and ammonia nitrogen were not affected but total nitrogen removal decreased. Selected NASIDs under environmental concentration stimulated the activity of superoxide dismutase (SOD) and the production of extracellular polymeric substances (EPS). The increased Shannon-Wiener diversity index suggested that bacterial diversity was enriched with the addition of selected NSAIDs. 16S rRNA gene sequencing results indicated that Proteobacteria, Actinobacteria, TM7 and Bacteroidetes were dominant. Actinobacteria and Bacteroidetes increased with the addition of selected NSAIDs.

The effects of sucralose and acesulfame on microbial community structure and

characteristics of activated sludge

Shaoli Li,Jinju Geng*, Hongqiang Ren

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, China

Artificial sweeteners (ASs) are listed as emerging contaminants due to their environmental persistence and wide occurrence in the water environment. Little study is available about the influence of ASs in the aqueous environments. To investigate the bioreactor effluent quality changes, microbial activity and community characteristics under sucralose (SUC) and acesulfame (ACE) selective pressure, sequencing batch reactors (SBRs) were used with environmentally relevant concentration (100ug/L). Chemical oxygen demand (COD), ammonia nitrogen(NH4+-N), total nitrogen (TN) removals appeared unchanged ($p > 0.05$), but the two ASs inhibited the degradation rate of NH4+-N in single cycling. Extracellular polymeric substances (EPS) concentrations slightly increased under SUC and ACE compared with the control ($p<0.05$). Under the two ASs selective pressures, specific oxygen uptake rate (SOUR) was lower, which suggested that sludge activity has been inhibited. Phospholipid fatty acid (PLFA) was used to detect the microbial community both qualitatively and quantitatively. Under the ASs pressures, the ratio of gram-negative bacteria (G-bacteria) was increased while the ratio of gram-positive bacteria (G+bacteria) was reduced. Shannon-Wiener diversity index was 0.82 in the control while ACE and SUC were 0.78 and 0.69, respectively.

Effect of process parameters and operational modes on nitrous oxide emissions from CASS treating low-strength domestic wastewater

Abstract

Weihao Liang, Nianjia Mao,Hongqiang Ren, Jinju Geng, Lili Ding, Ke Xu*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

In this study, lab-scale CASS simulating full-scale CASS were operated to treat synthetic low-strength domestic wastewater for evaluating the effects of process parameters (influent C/N ratio, carbon source and pH) and operation modes on N2O emission. For CASS treating domestic wastewater with low C/N ratio on the premise of sufficient DO, N2O emission primarily derived from denitrification. Influent C/N ratio of 5 would be optimal. Acetate feeding produced more N2O from nitrification and less N2O from denitrification than glucose and peptone feeding, accompanied by higher TN removal. High pH resulted in higher TN removal and less N2O accumulation during denitrification, simultaneously promoted N2O production during nitrification. For achieving acceptable TN removal and N2O conversion rate, pH ranged from 7.0~8.0 is optimum. Adding pre-anoxic section, continuous feeding and step feeding could mitigate N2O emission with enhanced nitrogen removal. For gaining new insight into N2O generation mechanism under these conditions, denitrification functional genes, enzymes and microbial community were analyzed systematically. Taxonomic analysis based on high-throughput 16S rRNA gene sequencing revealed that higher abundance of denitrifying bacteria, especially N2O-reducing bacteria leaded to less N2O emission. Dechloromonas and Zoogloea were the dominant N2O-reducing bacteria in CASS. It was interesting that the abundances of denitrification functional genes did not completely correlate with denitrification enzymes activities and the abundances of denitrification bacteria.

Cultivation of anammox sludge in anEGSB reactor with MnO_2 powder addition

Abstract

Nianjia Mao, Shuhan Wen, Hongqiang Ren, Jinju Geng, Lili Ding, Ke Xu*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

Anaerobic ammonium oxidation (Anammox), a promising biological nitrogen removal process, has become a research focus worldwide. Nevertheless, the long startup period of anaerobic ammonium oxidation greatly restricts its further application. In this study, the cultivation of anammox sludge with MnO2 powder addition was investigated in two EGSB reactor. One was the experiment reactor with the addition of MnO2 powder, the other was the control reactor. After 120 days' operation, both reactors reached stationary phase. Reactor with MnO2 powder addition showed higher nitrogen removal efficiency of 848.04 mg/(L•d) while the control reactor was 441.48 mg/(L•d). microbial structure analysis with High-throughput 16S rRNA sequencing verified that during this process, genus Candidate Brocadia, a typical anaerobic ammonium oxidation bacteria (AAOB) was significantly enriched and accounted for 5.1% of total bacteria in controller reactor and 8.5% of total bacteria in reactor with MnO2 powder addition. QPCR analysis revealed that reactor with MnO2 powder addition had higher abundance of Anammox 16S rRNA and functional genes hzsB contrast to the controller reactor. Besides, brick red fine particles can be observed in biomass in both reactors, which can be a symbol of anammox sludge.

The oxidative stress in the liver of Carassius auratus exposed to acesulfame and its UV irradiance products

Abstract

Yuhang Ren, Jinju Geng*, Fuchang Li, Hongqiang Ren, Lili Ding, Ke Xu

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, People's Republic of China

Acesulfame (ACE) is listed as an emerging contaminant due to its environmental persistence and wide occurrence in the environment. ACE can be degraded partially in the regular UV disinfection process but the eco-toxicity of its irradiation products remains unclear. This study focused on the possible oxidative status change in the liver of Carassius auratus exposed to ACE and its irradiation products. The UV degradation of ACE follows pseudo-first-order kinetics, and eight irradiation products were identified. Fish were exposed 7 d to 0.1 and 10 mg/L ACE (ACE group) and ACE after UV irradiance (ACE-UV group). The oxidative stress in fish liver exposed to ACE group had no distinct change. However, in the ACE-UV group, the quantity of •OH was induced by 17.96~55% and the MDA content increased by 16.28~68.28% compared to control. Time-effect exposure in the ACE-UV group showed that in the first 3 d the quantity of •OH reached its peak, causing severe inhibition of SOD and continuous inducement of GPx. GSH helped scavenge •OH and decreased below control after 3 d. An increased toxicity of ACE after UV irradiance was observed and its transfer after into aquatic environment needs to be recognized as an environmental risk.

Mechanisms of different methanogenic inhibition induced by inorganic nitrogen in anaerobic wastewater treatment process

Abstract

Runhua Su, Lina Zhou, Lili Ding, Hongqiang Ren*, Jinju Geng, Ke Xu

State Key Laboratory of Pollution Control and Resource Reuse, School of Environment, Nanjing University, Nanjing 210023, China

Inhibition of ammonia, nitrite and nitrate is a detrimental factor in the anaerobic digesters. In this study, methane production, cell viability, ATP, methanogenic coenzymes (CoF420 and CoM) and microbial community structure were compared under separate stress of ammonium, nitrate and nitrite concentrations to investigate the anaerobic inhibition mechanism. Results showed that the EC50 values of methane production of nitrite, nitrate and ammonia in the anaerobic system was 12 mg N/L, 30 mg N/L and 3000 mg N/L, respectively. Nitrite and nitrate concentrations larger than 120 mg N/L could decrease the cell viability by disrupting cell integrity, and all of the three nitrogen affect ATP concentration. Nitrite and ammonia decreased both coenzyme concentration at 120 and 1800 mg N/L, respectively, and when nitrate concentration was increased to over 120 mg N/L, only coenzyme M concentration declined. Besides, anaerobic bacteria and methanogens 16S rRNA gene amplicon sequencing data was in accordance with the result of methanogenesis inhibition. Under high stress of three inorganic nitrogen compounds (>EC50), the dominant bacteria phyla species were Actinobacteria, Proteobacteria, Chloroflexi, Bacteroidetes and Thermotogae had self-regulation among hydrolysis, acidogenesis and acetogenesis. Archaea Methansaeta and Methanobacterium had higher tolerance on nitrogen compounds toxicity within the study concentration range. RDA indicated that the microbial community was associated with the concentration and toxicity of the nitrogen compounds.

The effect of temperature decrease onmcrA genes and their transcripts in Methanogens of wastewater treatment system

Abstract

Chao Yu, Lili Ding, Hongqiang Ren*

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University

Low temperature anaerobic sewage treatment has been one of the crucial problems present in the field of environmental water and wastewater treatment and Methanogens cold adapted mechanism remains poorly understood. In the present study, we monitored the specific methanogenic activity (SMA) of anaerobic sludge cultivated in 15℃, 25℃ and 35℃ with three kinds of carbon sources, as well as the abundance of mcrA genes(encoding the α subunit of methyl coenzyme M reductase) and their transcripts. We found that temperature decrease had a significant ($P<0.01$) inhibiting effect on SMA. Quantitative PCR analysis revealed that both mcrA genes and transcripts decreased as s response to temperature decrease. Correlation analysis showed that the abundance of mcrA transcripts positively correlated with SMA ($r=0.793$, $P<0.01$) while mcrA genes abundance showed weak significant correlation ($r=0.490$, $P=0.02$). Interestingly, the coenzyme M concentration correlated with mcrA genes abundance strongly ($r=0.912$, $p<0.01$), both of which can reveal the amount of Methanogens. This suggests that temperature decrease significantly reduce the activity of Methanogens rather than kill them and mcrA transcripts abundance can be a more accurate and effective indicator for methanogenic activity than genes abundance.

In situ activity recovery of aging biofilm in biological aerated filter: surfactants treatment and mechanisms study

Abstract

Qisheng Yu, Hui Huang, Hongqiang Ren*, Lili Ding, Jinju Geng

State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing 210023, Jiangsu, PR China

In situ activity recovery of aging biofilm in the biological aerated filter (BAF) is an important but underappreciated problem. Lab-scaled BAFs were established in this study and three kinds of surfactants containing sodium dodecyl sulfate (SDS), sodium dodecyl benzene sulfonate (SDBS) and rhamnolipid were employed. Multiple indicators including effluent qualities, dissolved organic matters, biofilm physiology and morphology characteristics were investigated to explore the mechanisms. Results showed that removal rates of effluent COD in test groups significantly recovered to the level before aging. Compared with the control, effluent in SDBS and rhamnolipid-treated groups obtained more protein-like and humic-like substances, respectively. Furthermore, great live cell ratio, smooth surface and low adhesion force of biofilm were observed after rhamnolipid treatment, which was in consistent with good effluent qualities in the same group. This is the first report of applying rhamnolipid for in situ activity recovery of aging biofilm in bioreactors.

2016 China-US Joint Symposium

International Nexus of Food, Energy, Water, and Soil

PARTICIPANTS

List of Participants

(Alphabetical order)

No.	Participants	Institution/university	E-mail
1	Dr. Warren Washington	National Center for Atmospheric Research	wmw@ucar.edu
2	Dr. William Brown	University of Tennessee	wbrown15@utk.edu
3	Dr. John Stier	University of Tennessee	jstier1@utk.edu
4	Dr. Bruce K. Hamilton	National Science Foundation	bhamilto@nsf.gov
5	Dr. James W. Jones	National Science Foundation	jwjones@nsf.gov
6	Dr. Gary S. Sayler	University of Tennessee	sayler@utk.edu
7	Dr. Pedro Alvarez	Rice University	alvarez@rice.edu
8	Dr. Terry C. Hazen	University of Tennessee and Oak Ridge National Laboratory	tchazen@utk.edu
9	Dr. Frank Loëffler	University of Tennessee and Oak Ridge National Laboratory	frank.loeffler@utk.edu
10	Dr. Joseph Suflita	University of Oklahoma	jsuflita@ou.edu
11	Dr. Mark Nanny	University of Oklahoma	nanny@ou.edu
12	Dr. Lee D. Han	University of Tennessee	lhan@utk.edu
13	Dr. Max Cheng	University of Tennessee	zcheng@utk.edu
14	Dr. Siqun Wang	The University of Tennessee	swang@utk.edu
15	Dr. Jennifer Jurado	Natural Resources Planning and Management Division, Broward County	jjurado@broward.org
16	Dr. Yuji Arai	University of Illinois at Urbana Champaign	yarai@illinois.edu
17	Dr. Esther S. Parish	Oak Ridge National Laboratory	parishes@ornl.gov
18	Dr. Ling Zhao	University of Tennessee	lzhao7@utk.edu
19	Dr. Theodore B. Henry	Heriot-Watt University	t.henry@hw.ac.uk
20	Dr. Brian Leib	University of Tennessee	bleib@utk.edu
21	Dr. Jennifer	University of Tennessee	jdebruyn@utk.edu

Participants

	DeBruyn		
22	Dr. Sindhu Jagadamma	University of Tennessee	sjagada1@utk.edu
23	Dr. Jun Yan	University of Tennessee	jyan5@utk.edu
24	Dr. Shawn A. Hawkins	University of Tennessee	shawkins@utk.edu
25	Dr. Qiang He	University of Tennessee	qianghe@utk.edu
26	Mr. Andy Binford	Tennessee Department of Environment and Conservation	andy.binford@tn.gov
27	Dr. Wei Zhang	Michigan State University	weizhang@msu.edu
28	Dr. Hui Li	Michigan State University	lihui@msu.edu
29	Dr. Jiaguo Qi	Michigan State University	qi@msu.edu
30	Dr. Jinhua Zhao	Environmental Science and Policy Program	jzhao@msu.edu
31	Dr. Scott A. Bradford	United States Department of Agriculture	Scott.Bradford@ars.usda.gov
32	Dr. Ernest R. Blatchley	Purdue University	blatch@ecn.purdue.edu
33	Ms. Yichen Zhang	University of California, Davis	yyzhang@ucdavis.edu
34	Ms. Lidong Li	University of Tennessee	lli59@vols.utk.edu
35	Ms. Wanwan Liang	University of Tennessee	wliang@vols.utk.edu
36	Dr. Jun Chen	Nanjing University	
37	Dr. Gui-Bin Jiang	Research Center for Eco-Environmental Sciences, CAS	gbjiang@rcees.ac.cn
38	Dr. Nanqi Ren	Harbin Institute of Technology	rnq@hit.edu.cn
39	Dr. Quanxing Zhang	Nanjing University	zhqx@nju.edu.cn
40	Dr. Guirui Yu	Institute of Geographic Science and Natural Resources Research, CAS	yugr@igsnrr.ac.cn
41	Dr. Ming-An Shao	Institute of Geographic Science and Natural Resources Research, CAS	shaoma@igsnrr.ac.cn
42	Dr. Ai-Jie Wang	Research Center for Eco-Environmental Sciences, CAS	ajwang@rcees.ac.cn
43	Dr. Xu-Dong Zhang	Institute of Applied Ecology, CAS	xdzhang@iae.ac.cn
44	Dr. Jin-Shui Wu	Institute of Subtropical Agriculture, CAS	jswu@isa.ac.cn
45	Dr. Ji-Ping Shi	Shanghai Advanced Research Institute, CAS	shijp@sari.ac.cn
46	Dr. Jian-Ming Xu	Zhejiang University	jmxu@zju.edu.cn
47	Dr. Zhong-Hua Tong	University of Science and Technology of China	zhtong@ustc.edu.cn

Participants

48	Dr. Dong-Mei Zhou	Institute of Soil Science, CAS	dmzhou@issas.ac.cn
49	Dr. Jie Bao	East China University of Science and Technology	jbao@ecust.edu.cn
50	Dr. Ren-Jie Dong	China Agricultural University	Email: rjdong@cau.edu.cn
51	Dr. Bin Zhang	Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences	bzhang@caas.ac.cn
52	Dr. Ling-Tian Xie	Institute of Applied Ecology, CAS	xielt@iae.ac.cn
53	Dr. Gen-Xing Pan	Nanjing Agricultural University	pangenxingg@aliyun.com
54	Dr. Fangjie Zhao	Nanjing Agricultural University	fangjie.zhao@njau.edu.cn
55	Dr. Jun Bi	Nanjing University	jbi@nju.edu.cn
56	Dr. Gengxin Zhang	Institute of Tibetan Plateau Research, CAS	pangenxing@aliyun.com
57	Dr. Tong Zhang	HongKong University	zhangt@hku.hk
58	Dr. Wei Li	Nanjing University	liwei_isg@nju.edu.cn
59	Dr. Xinde Cao	Shanghai Jiaotong University	xdcao@sjtu.edu.cn
60	Dr. Xiaowei Zhang	Nanjing University	zhangxw@nju.edu.cn
61	Dr. Yufang Song	Institute of Applied Ecology, CAS	songyufang@iae.ac.cn
62	Dr. Cheng Gu	Nanjing University	chenggu@nju.edu.cn
63	Dr. Hongting Zhao	Hangzhou Dianzi University of Science and Technology	hzhao@hdu.edu.cn
64	Dr. Hongyan Guo	Nanjing University	hyguo@nju.edu.cn
65	Dr. Liding Chen	Research Center for Eco-environmental Sciences, CAS	liding@rcees.ac.cn
66	Dr. Lingtian Xie	Institute of Applied Ecology, CAS	xielt@iae.ac.cn
67	Dr. Shihui Yang	Hubei University	shhyoung@hotmail.com
68	Dr. Shourong Zheng	Nanjing University	srzheng@nju.edu.cn
69	Dr. Shujuan Zhang	Nanjing University	sjzhang@nju.edu.cn
70	Dr. Honglin He	Institute of Geographic Science and Natural Resources Research, CAS	Hehl@igsnrr.ac.cn
71	Dr. Tianming Cai	Nanjing Agricultural University	
72	Dr. Zhongliang Wang	Tianjin Formal University	zhongliang_wang@163.com

Participants

73	Dr. Dongmei Xue	Tianjin Formal University	xuedongmeixdm@126.com
74	Dr. Bin Fu	Institute of Applied Ecology, CAS	
75	Dr. Hong Xiao	Institute of Applied Ecology, CAS	
76	Dr. Yuhu Zhang	Capital Formal University	zhang_yuhu@163.com
77	Dr. Guodi Zheng	Institute of Applied Ecology, CAS	zhenggd@igsnrr.ac.cn
78	Dr. Xijuan Chen	Institute of Applied Ecology, CAS	chenxj@iae.ac.cn
79	Dr. Lin Ye	Nanjing University	linye@nju.edu.cn
80	Dr. Yuanchun Zhou	University of Science and Technology of China	Zhouych11@nju.edu.cn
81	Dr. Wei Shi	Nanjing University	fanfan_67946@163.com
82	Dr. Xinyi Cui	Nanjing University	Lizzycui@nju.edu.cn
83	Dr. Xiuying Li	Institute of Applied Ecology, CAS	lixiuying@iae.ac.cn