Environmental Contamination

Health Risks and Ecological Restoration

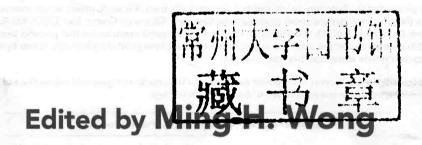
Edited by Ming H. Wong





Environmental Contamination

Health Risks and Ecological Restoration





CRC Press is an imprint of the Taylor & Francis Group, an **informa** business CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742

© 2013 by Taylor & Francis Group, LLC CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed and bound in Great Britain by TJ International Ltd, Padstow, Cornwall Version Date: 20120518

International Standard Book Number: 978-1-4398-9238-1 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (http://www.copyright.com/) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Environmental contamination : health risks and ecological restoration / editor, Ming H. Wong.

p. cm.

From the Croucher Advanced Study Institute workshop 2010, entitled Remediation of contaminated land bioavailability and health risk, held at the Hong Kong Baptist University, between December 9 and 13, 2010.

Includes bibliographical references and index.

ISBN 978-1-4398-9238-1 (hardback)

1. Pollution--Congresses. 2. Restoration ecology--Congresses. I. Wong, Ming H. II. Croucher Foundation.

TD172.5.E5585 2012 363.73--dc23

2012017901

Visit the Taylor & Francis Web site at http://www.taylorandfrancis.com

and the CRC Press Web site at http://www.crcpress.com

Environmental Contamination

Health Risks and Ecological Restoration

Preface

The chapters in this book are a collection of the lectures and discussion held during the Croucher Advanced Study Institute (ASI) workshop 2010, entitled Remediation of Contaminated Land—Bioavailability and Health Risk, held at the Hong Kong Baptist University, between December 9 and 13, 2010.

Croucher ASI is a new funding initiative of the Croucher Foundation catering to the interests of established scientists, with the main objective of regularly bringing to Hong Kong the leading international experts in specific fields to conduct refresher programs for a limited number of established scientists on highly focused scientific topics. The workshop series also provided an excellent opportunity for young scientists from Hong Kong, mainland China, and South-East Asian countries to learn from the leading scientists from the region and overseas.

As a result, we hope to disseminate to the readers the knowledge exchanged on the latest remediation technologies for pollutant cleanup of contaminated lands, the issues of bioavailability of chemicals, and their associated human risks.

This book covers the timely scientific research of 22 distinguished, leading experts, specializing on different aspects relevant to the topic.

I would like to take this opportunity to express my sincere thanks to Dr. Ji Dong Gu of Hong Kong University for co-organizing this workshop, the authors for their contribution, and the Croucher Foundation for their continued support, and last but not least, to Sue Fung for her expert editorial assistance.

Ming Hung Wong

Editor

Professor Ming Hung Wong, BSc (CUHK), MSc, PhD, DSc (Durham), MBA, DSc (Strathclyde), is dean of School of Environmental and Resource Sciences at Zhejiang Agriculture and Forestry University, and chair professor of biology and honorary director of the Croucher Institute for Environmental Sciences at Hong Kong Baptist University. His major research areas include ecotoxicological assessment and remediation of sites contaminated with toxic metals and persistent organic pollutants, and bioconversion of waste. He has been awarded a DSc each from the University of Durham and the University of Strathclyde based on papers published during the period 1977–1990 and 1991–2002, respectively.

Professor Wong served as the regional coordinator of Central and North-East Asia for the project entitled "Regionally Based Assessment of Persistent Toxic Substances" and recently joined a panel of three to review "Emerging Chemicals Management Issues in Developing Countries and Countries with Economies in Transition," which was sponsored by the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF). Currently, he is editor-in-chief of *Environmental Geochemistry and Health* (Springer) and editorial board member of five other international scientific journals.

Professor Wong has published over 450 peer-reviewed papers and 24 book chapters and has served as the editor of 22 books/special issues of scientific journals. He is currently the most cited Chinese scientist in the world in the field of environment/ecology, according to the Web of Science.

Contributors

Alan J.M. Baker

School of Botany The University of Melbourne Melbourne, Victoria, Australia and

Centre for Contaminant Geoscience Environmental Earth Sciences International Pty Ltd North Sydney, New South Wales, Australia

Hao Ban

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Nicholas T. Basta

School of Environment and Natural Resources The Ohio State University Columbus, Ohio

Amanda Black

Department of Soil and Physical Sciences Lincoln University Christchurch, New Zealand

Zhihong Cao

Institute of Soil Science Chinese Academy of Sciences and Joint Laboratory on Soil and

Environment co-organized by
Institute and Hong Kong Baptist
University

Nanjing, Jiangsu, People's Republic of China

Cameron S. Crook

Cameron S Crook & Associates Preston, United Kingdom

Richard P. Dick

School of Environment and Natural Resources The Ohio State University Columbus, Ohio

Nicholas M. Dickinson

Department of Ecology Lincoln University Christchurch, New Zealand

Augustine Doronila

School of Chemistry The University of Melbourne Parkville, Victoria, Australia

J. Bryan Ellis

Urban Pollution Research Centre Middlesex University London, United Kingdom

Kathryn A. Gogolin

Department of Biology Colorado State University Fort Collins, Colorado

Ji-Dong Gu

Laboratory of Environmental Microbiology and Toxicology School of Biological Sciences The University of Hong Kong Hong Kong, People's Republic of China

Guanyu Guan

National Research Center for Environmental Toxicology (EnTox) The University of Queensland Brisbane, Queensland, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Yongyong Guo

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province

Shantou University Medical College Shantou, Guangdong, People's Republic of China

William Hartley

Department of Computing, Science and Engineering University of Salford Greater Manchester, United Kingdom

Jinrong Huang

Analytic Cytology Laboratory and

Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Yeqing Huang

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China

Xia Huo

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Liping Jiao

Key Laboratory of Global Change and Marine-Atmospheric Chemistry

Third Institute of Oceanography, State Oceanic Administration Xiamen, Fujian Province, People's Republic of China

Lin Ke

College of Environmental Science and Engineering South China University of Technology Guangzhou, Guangdong, People's

and

Department of Biology and Chemistry City University of Hong Kong Hong Kong, People's Republic of China

Republic of China

Peeranart Kiddee

Centre for Environmental Risk Assessment and Remediation University of South Australia Mawson Lakes, South Australia, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia Contributors xv

Ki-Rak Kim

School of Environmental Science and Engineering Gwangju Institute of Science and Technology Gwangju, Korea

and

School of Engineering and Science Stevens Institute of Technology Hoboken, New Jersey

Kyoung-Woong Kim

School of Environmental Science and Engineering Gwangju Institute of Science and Technology Gwangju, Korea

Lillian Y.Y. Ko

Hong Kong Child Development Centre Kowloon, Hong Kong, People's Republic of China

Myoung-Soo Ko

School of Environmental Science and Engineering Gwangju Institute of Science and Technology Gwangju, Korea

Paul K.L. Lam

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China

Anna O.W. Leung

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China Clement K.M. Leung
IVF Centre Limited
Hong Kong Sanatorium and
Hospital
Hong Kong, People's Republic of

Weitang Liao

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Junxiao Liu

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Wei Liu

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Lian Lundy Urban Pollution Research Centre Middlesex University London, United Kingdom

Ming Man

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China

Mallavarapu Megharaj

Centre for Environmental Risk Assessment and Remediation University of South Australia Mawson Lakes, South Australia, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Ravi Naidu

Centre for Environmental Risk Assessment and Remediation University of South Australia Mawson Lakes, South Australia, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Jack C. Ng

The University of Queensland National Research Center for Environmental Toxicology (EnTox) Brisbane, Queensland, Australia and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Cheng Peng

The University of Queensland National Research Center for Environmental Toxicology (EnTox) Brisbane, Queensland, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Kongkea Phan

Soil Environment Laboratory School of Environmental Science and Engineering Gwangju Institute of Science and Technology Gwangju, Republic of Korea

and

Resource Development International-Cambodia Kandal, Cambodia

Marinus Pilon

Department of Biology Colorado State University Fort Collins, Colorado

Elizabeth A.H. Pilon-Smits

Department of Biology Colorado State University Fort Collins, Colorado

Yan Yan Qin

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China

D. Michael Revitt

Urban Pollution Research Centre Middlesex University London, United Kingdom

R. Brian E. Shutes

Urban Pollution Research Centre Middlesex University London, United Kingdom

Suthipong Sthiannopkao

Department of Environmental Engineering College of Engineering Dong-A University Busan, Republic of Korea

Nora F.Y. Tam

Department of Biology and Chemistry City University of Hong Kong Hong Kong, People's Republic of China

Palanisami Thavamani

Centre for Environmental Risk Assessment and Remediation University of South Australia Mawson Lakes, South Australia, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Kadiyala Venkateswarlu

Centre for Environmental Risk Assessment and Remediation University of South Australia Mawson Lakes, South Australia, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

and

Department of Microbiology Vikrama Simhapuri University Nellore, India

Jian Ping Wang

The University of Queensland National Research Center for Environmental Toxicology (EnTox) Brisbane, Queensland, Australia

and

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment Adelaide, South Australia, Australia

Yuanping Wang

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's

Republic of China

试读结束: 需要全本请在线购买: www.ertongbook.com

Yuping Wang

Laboratory of Environmental Microbiology and Toxicology School of Biological Sciences The University of Hong Kong Hong Kong, People's Republic of China

Ron T. Watkins

Department of Applied Geology Curtin University Perth, Western Australia, Australia

Chris K.C. Wong

Croucher Institute for Environmental Sciences and Department of Biology Hong Kong Baptist University Hong Kong, People's Republic of China

Ming Hung Wong

School of Environmental and Resource Sciences Zhejiang Agriculture and Forestry University Linan, People's Republic of China

and

Croucher Institute for
Environmental Sciences
Hong Kong Baptist University
Hong Kong, People's Republic of
China

Kusheng Wu

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China Shengchun Wu

Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China

Qin Wu

School of Environment and Natural Resources The Ohio State University Columbus, Ohio

Qiongna Xiao

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Xijin Xu

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China

Hui Yang

Analytic Cytology Laboratory and Key Immunopathology Laboratory of Guangdong Province Shantou University Medical College Shantou, Guangdong, People's Republic of China Contributors

Tingting You School of Life Sciences Sun Yat-Sen University Guangzhou, Guangdong Province, People's Republic of China

Gene J.S. Zheng Croucher Institute for Environmental Sciences Hong Kong Baptist University Hong Kong, People's Republic of China Guina Zheng
Analytic Cytology Laboratory
and
Key Immunopathology Laboratory
of Guangdong Province
Shantou University Medical College
Shantou, Guangdong, People's
Republic of China

Contents

Preface	ix
Editor	Xi
Contributors	xiii
1 Environmental Contamination: Health Ri	
and Ecological Restoration Ming Hung Wong	opening the harmonic
Part I Health Impacts and Risk Ass	essment
2 Health Impacts of Toxic Chemicals in the The Need for Healthcare Reform?	
Paul K.L. Lam and Ming Hung Wong	
3 Heavy Metal Overloads and Autism in Ch	
Mainland China and Hong Kong: A Prelin Lillian Y.Y. Ko, Yan Yan Qin, and Ming Hung	
4 Endocrine-Disrupting Contaminants and	
on Reproductive and Developmental Heal Chris K.C. Wong	lth
5 Assessing Health Risks from Arsenic Inta	
in Cambodia	63
Suthipong Sthiannopkao, Kongkea Phan, Kyoun and Ming Hung Wong	g-Woong Kim,
6 Pragmatic Approach for Health Risk Asse	ssment
of Bauxite Tailing Waste Materials	
Jack C. Ng, Jian Ping Wang, Cheng Peng, and C	Guanyu Guan
	intented thereath I have
Part II Emerging Chemicals and Ele	ectronic Waste
7 Polybrominated Diphenyl Ethers in China	a: Sources, Trends,
and Their Adverse Impacts on Human He	
Gene J.S. Zheng, Liping Jiao, Anna O.W. Leung	
Yeqing Huang, Tingting You, and Ming Hung	viong

8	Removal of Persistent Organic Pollutants and Compounds of Emerging Concern in Public-Owned Sewage Treatment	
		145
9	Inverse Relationship between Urinary Retinol-Binding Protein, Beta-2-Microglobulin, and Blood Manganese Levels in School-Age Children from an E-Waste Recycling Town	183
	Jinrong Huang, Xijin Xu, Guina Zheng, Kusheng Wu, Yongyong Guo, Junxiao Liu, Hao Ban, Weitang Liao, Wei Liu, Hui Yang, Qiongna Xiao, Yuanping Wang, and Xia Huo	
10	Mitigating Environmental and Health Risks Associated with Uncontrolled Recycling of Electronic Waste: Are International	
	And National Regulations Effective?	193
11	Decision-Making Support Tools for Managing Electronic Waste Peeranart Kiddee, Ravi Naidu, and Ming Hung Wong	209
Pa	rt III Ecological Restoration of Contaminated Sites: Bioremediation	
12	Biomethylation of Arsenic in Contaminated Soils	. 231
13	Handling Copper: A Paradigm for the Mechanisms of Metal Ion Homeostasis	. 263
14	Plant Selenium Metabolism: Genetic Manipulation, Phytotechnological Applications, and Ecological Implications	. 295
15	Elizabeth A.H. Pilon-Smits Microbial Transformation of Phthalate Esters: Diversity	
15	of Hydrolytic Esterases	. 313
16	Mixed Contamination of Polyaromatic Hydrocarbons and Metals at Manufactured Gas Plant Sites: Toxicity	
	and Implications to Bioremediation Palanisami Thavamani, Mallavarapu Megharaj, Kadiyala Venkateswarlu, and Ravi Naidu	.347

Part IV	Ecological Restoration of Contaminated
	Sites: Phytoremediation

17	Toxicity and Bioavailability of Heavy Metals and Hydrocarbons in Mangrove Wetlands and Their Remediation
18	Origin of Paddy Fields and Functions for Environmental Remediation in the Urbanized Areas of Yangtze River Delta 393 Zhihong Cao
19	Remediation and Reuse of Stormwater by Ecotechnology
20	Phytostabilization for Sustainable End-Use of Arsenic-Rich Mine Tailings in the Victorian Goldfields, Australia
21	Field Application of the Stabilization Process for Arsenic-Contaminated Soil
22	Bioavailability of Metals and Arsenic on Brownfield Land: Remediation or Natural Attenuation for Risk Minimization? 473 Nicholas M. Dickinson, William Hartley, Amanda Black, and Cameron S. Crook
Ind	ex

Environmental Contamination: Health Risks and Ecological Restoration

Ming Hung Wong

CONTENTS

Introduction	2
Environmental Pollution of Public Concern: Some Examples	2
Deterioration of Environmental Quality due to Rapid Socioeconomic	
Development in the Pearl River Delta	
Soil Pollution Affecting Crops Grown in the Region	
Water Pollution Affecting Aquaculture Products Produced	
in the Region	
Environmental Pollutants, Food Intake, and Human Health	
Sources, Fates, and Effects of Toxic Chemicals	
Different Types of Environmental Pollutants	
Heavy Metals	7
Persistent Organic Pollutants	7
Stockholm Convention POPs	7
Flame Retardants	8
Polycyclic Aromatic Hydrocarbons	8
Emerging Chemicals of Concern	
Bisphenol A	9
Phthalates	9
Pharmaceuticals and Personal Care Products	9
Mixed Pollutants: Toxic Chemicals Emitted via Open	
Burning of E-Waste	
The Need to Remediate Contaminated Sites	11
Bioremediation of Contaminated Sites	11
Phytoremediation of Contaminated Sites	11
Issues Addressed in This Book	12
Health Impacts and Risk Assessment	12
Emerging Chemicals and E-Waste	13
Ecological Restoration of Contaminated Sites	13
Conclusion	14
Acknowledgments	15
References	15