

SOILS and GROUNDWATER POLLUTION and REMEDIATION

Asia, Africa, and Oceania

Suranaree University of Technology



31051000576353

Edited by

P.M. Huang
I.K. Iskandar

TABLE OF CONTENTS

Preface	vii
About the Editors	ix
Affiliation of Editors, Coeditors, and Contributors	xi
1 Environmental Impacts of Heavy Metals in Agroecosystems and Amelioration Strategies in Oceania	1
K.G. TILLER, M.J. McLAUGHLIN, AND A.H.C. ROBERTS	
Introduction	1
Background Concentrations of Heavy Metals in Australian and New Zealand Soils	1
Sources of Metals in Agroecosystems	3
Environmental Impact	10
Amelioration Strategies	17
Regulatory Control	28
Summary and Conclusions	35
References	35
2 Environmental Concerns of Pesticides in Soil and Groundwater and Management Strategies in Oceania	42
B.K.G. THENG, R.S. KOOKANA, AND A. RAHMAN	
Introduction	42
Usage	43
Behavior and Fate in Soil	50
Pesticide Residues in the Environment	59
Management and Remediation Options	68
Summary and Conclusions	70
Acknowledgments	70
References	71
3 Metal Pollution of Soil and Groundwater and Remediation Strategies in Japan	80
M. CHINO	
Introduction	80
Regulations and Control	81
Metals in Soil, Groundwater, Fertilizers, and Sewage Sludges of Japan	84
Remediation Strategies	87
Daily Intake of Heavy Metals by Japanese	90
Application of Sewage Sludge and Other Biosolids to Land and Heavy Metal Accumulation	91
References	95
4 Impact of Radionuclides on Soil, Groundwater, and Crops and Radionuclide Cleanup in Japan	96
S. UCHIDA AND Y. OHMOMO	
Introduction	96

	Meteorological Data in Japan	97
	Fallout Radionuclides (^{137}Cs , ^{90}Sr , Pu, etc.) Deposited on Soil	99
	Migration of Radionuclides in Soil and Groundwater	101
	Transfer of Radionuclides to Crops	108
	Decontamination of Radionuclides	118
	Summary and Conclusions	121
	Acknowledgments	122
	References	122
5	Effect of Anthropogenic Organic Compounds on the Quality of Soil and Groundwater and Remediation Strategies in Japan	126
	O. NAKASUGI AND T. HIRATA	
	Introduction	126
	Nationwide Survey Results	127
	Site Investigation for Volatile Organochlorines	132
	Remediation Technologies for Subsurface Pollution	141
	Summary and Conclusions	147
	References	148
6	Heavy Metal Pollution in Soils and Its Remedial Measures and Restoration in Mainland China	150
	H.K. WANG	
	Introduction	150
	Background Levels of Trace Elements in Soils of China	151
	Site Research of Soil Pollution in China	151
	Heavy Metal Pollutants and Their Influencing Factors	154
	Management Practices for the Mitigation of Heavy Metal Pollution in Soils of China	156
	Conclusions	163
	References	163
7	Environmental Impacts of Metal and Other Inorganics on Soil and Groundwater in China	167
	G.X. XING AND H.M. CHEN	
	Introduction	167
	Background Values of Elements in Soils of China	168
	Soil Loading Capacity for Heavy Metals	171
	Forms of Heavy Metals in Soils	179
	Heavy Metal Pollution of Soils in China	186
	Effect of the Amount of Dissolved Heavy Metals and Enrichment of Other Inorganics in Groundwater on Ecological Environment	193
	Summary and Conclusions	196
	References	197
8	Environmental Problems in Soil and Groundwater Induced by Acid Rain and Management Strategies in China	201
	G. L. JI, J. H. WANG, AND X. N. ZHANG	
	Introduction	201
	Acid Rain	201

Acidity and Acidification of Soils	205
Acidification of Groundwater	219
Strategies for Controlling the Acidification of the Soil Environment	221
Summary and Conclusions	222
Acknowledgments	222
References	222
9 Dynamics, Fate, and Toxicity of Pesticides in Soil and Groundwater and Remediation Strategies in Mainland China	225
D. J. CAI AND Z. L. ZHU	
Introduction	225
History of Pesticide Production and Usage in China	226
Dynamics, Fate, and Toxicity of Pesticides in Soil	228
Groundwater Contamination by Pesticides in China	244
Remediation Strategies for Soil and Groundwater Contamination by Pesticides in China	246
Summary and Conclusions	247
Acknowledgments	248
References	248
Appendix: Chemical Names of Pesticides Mentioned in Chapter 9	251
10 Perspectives of Environmental Pollution in Densely Populated Areas: The Case of Hong Kong	254
M. S. YANG AND M. H. WONG	
Introduction	254
Major Sources of Environmental Pollutants and Control Strategies	256
Effects of Pollution on Groundwater	263
Control and Remediation of Degraded Soil and Land	265
Future Perspectives	267
Summary and Conclusions	268
Acknowledgments	268
References	268
11 Environmental Impacts and Management Strategies of Trace Metals in Soil and Groundwater in the Republic of Korea	270
J. E. YANG, Y. K. KIM, J. H. KIM, AND Y. H. PARK	
Introduction	270
Present Status and Environmental Impacts of Trace Metals in Korean Soils	271
Management Strategies for Trace Metals in Korean Soils	281
Trace Metals in Groundwater	284
Management Strategies of Trace Metals in Groundwater	285
Summary and Conclusions	286
References	287
12 Transport, Residues, and Toxicological Problems of Agrochemicals in Agroecosystems and a Remediation Plan in the Republic of Korea	290
K. S. LEE AND B. H. SONG	
Introduction	290
Changes of the Patterns in Pesticide Use	291

Pesticide Residues in Agricultural Environments	294
Evaluation of the Effects of Pesticide Residues on Agricultural Environment....	300
Protection Strategies for Agricultural Ecosystems	312
Summary and Conclusions	322
Acknowledgments	323
References	323
Appendix: List of Pesticides Mentioned in Chapter 12	328
13 Toxic Metals and Agrochemicals in Soils in Malaysia: Current Problems and Mitigation Plans	330
Y.M. KHANIF, I.C. FAUZIAH, AND J. SHAMSHUDDIN	
Introduction	330
Fertilizer and Agrochemical Usage	331
Ecological Problems of Toxic Metals and Agrochemicals	335
Mitigation Plans	342
Summary and Conclusions	344
References	344
14 Status of Cadmium, Lead, and Selenium in the Soils of Selected African Countries and Perspectives of Their Effects on Human and Environmental Health	347
B. WAIYAKI	
Introduction	347
Soil Characteristics in Five Selected African Countries (Ethiopia, Ghana, Malawi, Sierra Leone, and Tanzania)	348
Status of Cadmium, Lead, and Selenium in the Soils of Selected African Countries	349
Status of Cadmium	351
Status of Lead	354
Status of Selenium	358
Sources, Forms, and Distribution of Cadmium and Human Exposure to It ..	362
Environmental Aspects of Cadmium	364
Sources, Forms, and Distribution of Lead and Human Exposure to It	364
Environmental Aspects of Lead	367
Sources, Forms, and Distribution of Selenium and Human Exposure to It ...	367
Summary and Conclusions/Recommendations	369
Acknowledgments	372
References	373