

REMEDICATION OF HAZARDOUS WASTE CONTAMINATED SOILS

EDITED BY

DONALD L. WISE

*Northeastern University
Boston, Massachusetts*

DEBRA J. TRANTOLO

*Cambridge Scientific, Inc.
Belmont, Massachusetts*



Marcel Dekker, Inc.

G 12767
New York • Basel • Hong Kong

Contents

<i>Preface</i>	iii
<i>Contributors</i>	ix
Part I: ENGINEERING ISSUES IN WASTE REMEDIATION	
1 Ethical Responsibilities of Environmental Engineers <i>Merrit P. Drucker</i>	1
2 Risk Assessment in the Remediation of Hazardous Waste Sites <i>Stephen T. Washburn, Jill Warnasch, and Robert H. Harris</i>	9
3 Practical Considerations During Bioremediation <i>Ronald D. Fletcher</i>	39
4 Engineering Aspects of Bioremediation <i>Subrata Bandyopadhyay, Sanjoy K. Bhattacharya, and Priyodarshi Majumdar</i>	55
5 Application of Genetic Engineering to the Field of Bioremediation <i>Alan R. Harker, Youngjun Kim, and Udayakumar Matrubutham</i>	77
6 Applications of Environmental Biotechnology to Bioremediation <i>John Sanseverino, James T. Fleming, Armin Heitzer, Bruce M. Applegate, and Gary S. Sayler</i>	97
7 Computer-Assisted Site Characterization: Environmental Data Management, Analysis, and Visualization <i>Peter J. Pace and Kevin M. Savage</i>	125

Part II: SPECIFIC CASE STUDIES IN HYDROCARBON REMEDIATION

- | | | |
|----|---|-----|
| 8 | Biodegradation of Polynuclear Aromatic Hydrocarbons in Coal Tar Oil Contaminated Soil
<i>Curtis A. Lajoie and Peter F. Strom</i> | 149 |
| 9 | Bioremediation and Reuse of Soils Containing No. 5 Fuel Oil in New England Using an Above-Ground Treatment Cell: A Case Study
<i>Douglas A. Heely, Elliot S. Werk, and Richard G. Kowalski</i> | 163 |
| 10 | Effects of Bioremediation on Toxicity, Mutagenesis, and Microbiota in Hydrocarbon-Polluted Soils
<i>Xiaoping Wang and Richard Bartha</i> | 175 |
| 11 | Biodegradation of Phenol
<i>C. Vipulanandan, S. Wang, and S. Krishnan</i> | 199 |
| 12 | Bioremediation of Petroleum-Contaminated Soils at Railroad Facilities
<i>Marleen A. Troy, L. Bruce Allen, and Douglas E. Jerger</i> | 227 |
| 13 | Electrokinetically Enhanced In Situ Soil Decontamination
<i>Sibel Pamukcu and J. Kenneth Wittle</i> | 245 |
| 14 | Effects of Gender, Route of Administration, and Soil on the Bioavailability of Coal Tar Components
<i>Gloria A. Skowronski, Mohamed S. Abdel-Rahman, and Rita M. Turkall</i> | 299 |
| 15 | Bioremediation of Hydrocarbon-Contaminated Soils Using Indigenous Microbes
<i>Judith Bower Carberry</i> | 317 |
| 16 | Surfactant-Enhanced Bioremediation of Polynuclear Aromatic Hydrocarbons in Coke Waste
<i>John Sanseverino, Duane A. Graves, Maureen E. Leavitt, Satish K. Gupta, and Richard G. Luthy</i> | 345 |
| 17 | Engineering Application of Biooxidation Processes for Treating Petroleum-Contaminated Soil
<i>Chi-Yuan Fan and Anthony N. Tafuri</i> | 373 |

Part III: BIOREMEDIATION STRATEGIES

- | | | |
|----|--|-----|
| 18 | In Situ Remediation of Contaminated Soils Containing Hazardous Mixed Wastes by Bio-Electrokinetic Remediation and Other Competitive Technologies
<i>Robert E. Marks, Yalcin B. Acar, and Robert J. Gale</i> | 405 |
| 19 | Bioremediation of Hexavalent Chromium in Water, Soil, and Slag Using Sulfate-Reducing Bacteria
<i>Louis J. DeFilippi</i> | 437 |
| 20 | Status of Sea-Borne Bioremediation Technologies
<i>Photeinos Santas and Regas Santas</i> | 459 |

- 21 Biocolloid Formation: An Approach to Bioremediation of Toxic Metal Wastes 481
Larry L. Barton, H. E. Nuttall, William C. Lindemann, and Robert C. Blake II
- 22 Bioremediation of Hazardous Sludge from a Storage Pond 497
P. S. Kodukula
- 23 Improved Spatial Resolution in Vertical and Horizontal Holes for Measurement of Bioremediation Parameters and Histories 513
Carl Keller
- 24 Enhancement of Bioremediation by Partial Preoxidation 543
Judith Bower Carberry
- 25 Microbial Bioavailability of Residual Organic Contaminants in Soils 599
Kevin G. Robinson

Part IV: TRADITIONAL SOIL-SPECIFIC TECHNOLOGIES

- 26 The Use of Surfactants to Enhance Pump-and-Treat Processes for In Situ Soil Remediation 633
Sarah L. Kimball
- 27 Modeling Soil Bioremediation 645
Aaron A. Jennings and Ajay Manocha
- 28 Using Microbial Kinetics in the Bioremediation of Contaminated Soils 681
Jeremiah D. Jackson and Kent Zenobia
- 29 Enhanced In Situ Soil-Flushing Fundamentals 691
William G. Rixey
- 30 Modern In-Field Process Systems—Case Study: Soil Washing 719
Tim L. Jones and Abbas Ghassemi
- 31 Soil-Washing Processes for Site Remediation 745
Ronald M. Dennis, Daniel Dworkin, and Alan J. Zupko
- 32 Vapor Abatement Cost Analysis Methodology for Calculating Life-Cycle Costs for Hydrocarbon Vapor Extracted During Soil Venting 779
Peter M. Kroopnick
- 33 Soil Gas Movement—Monitoring Under Natural and Remediation Conditions 791
William B. Kerfoot

Part V: DEVELOPING METHODS

- 34 Micro-Scale Field Laboratory Methods for the Chemical Analysis of Samples for Use in Site Investigations and Remediation 831
Daniel M. Twomey, Jr. and Stephen A. Turner

35	Wet Air Oxidation of Hazardous Wastes <i>Oliver J. Hao and Kotu K. Phull</i>	849
36	DCR Technology in the Field of Environmental Remediation <i>Friedrich Boelsing</i>	869
	<i>Index</i>	925

Library of Congress Cataloging-in-Publication Data

Remediation of hazardous waste contaminated soils / edited by Donald L. Wise, Debra J. Trantolo.

p. cm. -- (Environmental science and pollution control series; 8)

Includes bibliographical references and index.

ISBN 0-8247-9160-6 (alk. paper)

1. Hazardous wastes--Environmental aspects. 2. Soil remediation. I. Wise, Donald L. (Donald Lee). II. Trantolo, Debra J. III. Series: Environmental science and pollution control; 8.

TD879.H38R46 1994

628.5'5--dc20

93-50098

CIP

The publisher offers discounts on this book when ordered in bulk quantities. For more information, write to Special Sales/Professional Marketing at the address below.

This book is printed on acid-free paper.

Copyright © 1994 by MARCEL DEKKER, INC. All Rights Reserved.

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming, and recording, or by any information storage and retrieval system, without permission in writing from the publisher.

MARCEL DEKKER, INC.

270 Madison Avenue, New York, New York 10016

Current printing (last digit):

10 9 8 7 6 5 4 3 2 1

PRINTED IN THE UNITED STATES OF AMERICA