

Environmental Science

Shree Nath Singh *Editor*

# Microbial Degradation of Xenobiotics

 Springer

# Microbial Degradation Of Xenobiotics Environmental Science And Engineering

**Lala Behari Sukla, Enketeswara  
Subudhi, Debabrata Pradhan**



## **Microbial Degradation Of Xenobiotics Environmental Science And Engineering:**

**Microbial Degradation of Xenobiotics** Shree Nath Singh, 2011-10-07 Our interest in the microbial biodegradation of xenobiotics has increased many folds in recent years to find out sustainable ways for environmental cleanup Bioremediation and biotransformation processes harness the naturally occurring ability of microbes to degrade transform or accumulate a wide range of organic pollutants Major methodological breakthroughs in recent years through detailed genomic metagenomic proteomic bioinformatic and other high throughput analyses of environmentally relevant microorganisms have provided us unprecedented insights into key biodegradative pathways and the ability of organisms to adapt to changing environmental conditions The degradation of a wide spectrum of organic pollutants and wastes discharged into the environment by anthropogenic activities is an emerging need today to promote sustainable development of our society with low environmental impact Microbial processes play a major role in the removal of recalcitrant compounds taking advantage of the astonishing catabolic versatility of microorganisms to degrade or transform such compounds New breakthroughs in sequencing genomics proteomics bioinformatics and imaging are generating vital information which opens a new era providing new insights of metabolic and regulatory networks as well as clues to the evolution of degradation pathways and to the molecular adaptation strategies to changing environmental conditions Functional genomic and metagenomic approaches are increasing our understanding of the relative importance of different pathways and regulatory networks to carbon flux in particular environments and for particular compounds New approaches will certainly accelerate the development of bioremediation technologies and biotransformation processes in coming years for natural attenuation of contaminated environments

**Development in Wastewater Treatment Research and Processes** Maulin P. Shah, Susana

Rodriguez-Couto, 2022-02-16 Development in Wastewater Treatment Research and Processes Microbial Degradation of Xenobiotics through Bacterial and Fungal Approach covers the active and applicable role that bacteria and fungi play in the degradation of xenobiotic compounds from the environment The book gives up to date information on recent advancements in the field of environmental xenobiotics and how they disturb a plant's metabolism The book also gives information on aerobic and anaerobic degradation of xenobiotic compounds through bacteria or fungi and or a combined approach Finally the book covers the characteristics of environmental microbiology biochemical engineering agricultural microbiology environmental engineering and soil bioremediation Emphasizes up to date research on the microbial degradation of xenobiotic compounds through a bacterial fungal approach Covers multidisciplinary features of environmental microbiology biochemical engineering agriculture microbiology environmental engineering and soil bioremediation Includes sections on aerobic and anaerobic degradation Presents the significance of the bacterial fungal role and their metabolic activities in the digestion of xenobiotic compounds Focuses on the most recent developments in environmental biotechnology to enhance the action of the bacterial fungal systems in the remediation of xenobiotic compounds

*Ecological Interplays in Microbial*

*Enzymology* Naga Raju Maddela, Aransiola Sesan Abiodun, Ram Prasad, 2022-11-10 This contributed volume compiles the latest developments in the field of microbial enzymology. It focuses on topics such as distribution of microbial enzymes in natural habitats, microbial enzymes in environmental sustainability and environmental disturbances on microbial enzymes which are organized into three parts respectively. Ranging from micro scale studies to macro, it covers a huge domain of microbial enzymes and their interplay between the components of the environment. Overall, the book portrays the importance of microbial enzyme technology and its role in solving the problems in modern day life. The book is a ready reference for practicing students and researchers in environmental engineering, chemical engineering, agricultural engineering and other allied fields.

**Microbial Action on Hydrocarbons** Vivek Kumar, Manoj Kumar, Ram Prasad, 2019-02-08 The book discusses ways to overcome the side effects of using hydrocarbon based products as energy sources. Hydrocarbons produce raw crude oil waste of around 600 000 metric tons per annum with a range of uncertainty of 200 000 metric tons per year. The various chapters in this book focus on approaches to reduce these wastes through the application of potential microbes in a process called bioremediation. The book is a one stop reference resource on the methods, mechanisms and application of the bio composites in the laboratory and field. Focusing on resolving a very pressing environmental issue, it not only provides details of existing challenges but also offers deeper insights into the possibility of solving problems using hydrocarbon bioremediation.

*Plant-Microbe Interaction under Xenobiotic Exposure* Swarnendu Roy, Vivekananda Mandal, 2025-07-26 This book presents the impact of a wide array of xenobiotic compounds on the physio biochemical and molecular parameters in an integrative format. It highlights recent advances in bioremediation strategies including the use of novel microorganisms, rhizosphere engineering, microbial enzymes and nanotechnology. By exploring the effects of xenobiotic exposure on plants and microbes holistically, this book aims to boost sustainable agriculture for the future. Key concepts include the mechanisms and strategies plants employ for detoxifying xenobiotics, microbial mitigation of plant stress and the role of nanobiosensors in environmental monitoring. Chapters delve into topics such as the ecological impacts of emerging pollutants, plant-microbe interactions under environmental stress and innovative bioremediation techniques. This comprehensive analysis makes the book a must read for understanding the challenges and solutions in managing xenobiotic impacts. Researchers, scholars and scientists in Plant Sciences, Agriculture and related fields will find this book invaluable. With illustrative schemes and sketches, the book effectively communicates complex ideas, drawing attention to the critical challenges of future food production and environmental issues. It is particularly relevant for academics, practitioners and policymakers seeking to understand and address the impacts of xenobiotics on ecosystems. By providing a detailed exploration of current research and innovative solutions, the book serves as a vital resource for those committed to fostering a sustainable future.

**Microbial Biodegradation and Bioremediation** Surajit Das, Hirak Ranjan Dash, 2021-11-24 *Microbial Biodegradation and Bioremediation Techniques and Case Studies for Environmental Pollution* Second Edition describes the successful application

of microbes and their derivatives for bioremediation of potentially toxic and relatively novel compounds in the environment. Our natural biodiversity and environment is in danger due to the release of continuously emerging potential pollutants by anthropogenic activities. Though many attempts have been made to eradicate and remediate these noxious elements, thousands of xenobiotics of relatively new entities emerge every day, thus worsening the situation. Primitive microorganisms are highly adaptable to toxic environments and can reduce the load of toxic elements by their successful transformation and remediation. This completely updated new edition presents many new technologies and techniques and includes theoretical context and case studies in every chapter. **Microbial Biodegradation and Bioremediation: Techniques and Case Studies for Environmental Pollution, Second Edition** serves as a single source reference and encompasses all categories of pollutants and their applications in a convenient comprehensive format for researchers in environmental science and engineering, pollution environmental microbiology and biotechnology. Describes many novel approaches of microbial bioremediation including genetic engineering, metagenomics, microbial fuel cell technology, biosurfactants and biofilm based bioremediation. Introduces relatively new hazardous elements and their bioremediation practices including oil spills, military waste, water, greenhouse gases, polythene wastes and more. Provides the most advanced techniques in the field of bioremediation including *in silico* approach, microbes as pollution indicators, use of bioreactors, techniques of pollution monitoring and more. Completely updated and expanded to include topics and techniques such as genetically engineered bacteria, environmental health, nanoremediation, heavy metals, contaminant transport and *in situ* and *ex situ* methods. Includes theoretical context and case studies within each chapter. **Environmental Microbiology: Fundamentals and Applications** Jean-Claude

Bertrand, Pierre Caumette, Philippe Lebaron, Robert Matheron, Philippe Normand, Télesphore Sime-Ngando, 2015-01-26. This book is a treatise on microbial ecology that covers traditional and cutting edge issues in the ecology of microbes in the biosphere. It emphasizes on study tools, microbial taxonomy and the fundamentals of microbial activities and interactions within their communities and environment as well as on the related food web dynamics and biogeochemical cycling. The work exceeds the traditional domain of microbial ecology by revisiting the evolution of cellular prokaryotes and eukaryotes and stressing the general principles of ecology. The overview of the topics authored by more than 80 specialists is one of the broadest in the field of environmental microbiology. The overview of the topics authored by more than 80 specialists is one of the broadest in the field of environmental microbiology. **Principles and Applications of Environmental**

**Biotechnology for a Sustainable Future** Ram Lakhan Singh, 2016-10-14. This textbook on Environmental Biotechnology not only presents an unbiased overview of the practical biological approaches currently employed to address environmental problems but also equips readers with a working knowledge of the science that underpins them. Starting with the fundamentals of biotechnology, it subsequently provides detailed discussions of global environmental problems including microbes and their interaction with the environment, xenobiotics and their remediation, solid waste management, waste water

treatment bioreactors biosensors biomining and biopesticides This book also covers renewable and non renewable bioenergy resources biodiversity and its conservation and approaches to monitoring biotechnological industries genetically modified microorganism and foods so as to increase awareness All chapters are written in a highly accessible style and each also includes a short bibliography for further research In summary this textbook offers a valuable asset allowing students young researchers and professionals in the biotechnology industry to grasp the basics of environmental biotechnology

*Biological Remediation of Explosive Residues* Shree Nath Singh, 2013-08-04 Microbial degradation Phytoremediation Remediation Explosive residues Biotransformation Mineralization Degradative Enzymes Degradation Pathways Energetics Soil contamination Water contamination

Biodegradable Polymers in the Circular Plastics Economy Michiel Dusselier, Jean-Paul Lange, 2022-05-06 Biodegradable Polymers in the Circular Plastics Economy A comprehensive overview of the burgeoning field of biodegradable plastics As the lasting impact of humanity's reliance on plastics comes into focus scholars have begun to seek out solutions to plastic litter In Biodegradable Polymers in the Circular Plastics Economy an accomplished team of researchers delivers a focused guide 1 to understand plastic degradation and its role in waste hierarchy besides recycling and 2 to create and use biodegradable plastics where appropriate Created preferably from renewable resources these eco friendly polymers provide an opportunity to create sustainable and lasting solutions to the growing plastic driven pollution problem The broad approach to this handbook allows the authors to cover all aspects of these emerging materials ranging from the problems present in the current plastics cycle to the differences in type production and chemistry available within these systems to end of life via recycling or degradation and to life cycle assessments It also delves into potential commercial and policy issues to be addressed to successfully deploy this technology Readers will also find A thorough introduction to biodegradable polymers focusing not only on the scientific aspects but also addressing the larger political commercial and consumer concerns Mechanisms of biodegradation and the environmental impact of persistent polymers An in depth discussion of degradable hydrolysable polyesters polysaccharides lignin based polymers and vitrimers Management of plastic waste and life cycle assessment of bio based plastics Biodegradable Polymers in the Circular Plastics Economy is the perfect overview of this complicated but essential research field and will appeal to polymer chemists environmental chemists chemical engineers and bioengineers in academia and industry The book is intended as a step towards a circular plastics economy that relies heavily on degradable plastics to sustain it

**Persistent Organic Pollutants in the Environment** Narendra Kumar, Vertika Shukla, 2021-09-30 Persistent Organic Pollutants POPs are toxic degradation resistant bio accumulative and display wide spatial distribution which has been linked to mutagenic reproductive and immunological disorders In Stockholm Persistent Organic Pollutants POPs are toxic degradation resistant bio accumulative and display wide spatial distribution which has been linked to mutagenic reproductive and immunological disorders At the Stockholm Convention a global treaty was signed to minimize and ultimately eliminate the release of POPs

into the environment The present compilation regarding POPs focusses on the sources atmospheric behavior terrestrial and aquatic food chain transfer human exposure and fate aspects of this important class of chemicals including topical issues like temporal trends in contamination Furthermore the chemical characteristics of individual POPs are also addressed Features Provides better understanding of Persistent Organic Pollutants POPs and how they affect humans and ecosystems Includes genesis categories environmental fate and behavior and associated hazards Reviews analytical techniques involved in detection human exposure and management Discusses environmental dynamics of POPs Focuses on the comprehensive account of PCDD Fs PCBs PAH and other organochlorine POPs such as DDT lindane and dieldrin This book is aimed at researchers professionals and graduate students in Life Science Occupational Health and Safety Chemical Engineering and Environmental Engineering Biotransformations: Microbial Degradation of Health-Risk Compounds V.P. Singh, 1995-04-25

A comprehensive and consolidated account of how microorganisms can play a significant role in degrading and detoxifying toxic carcinogenic mutagenic and teratogenic compounds is detailed in this book Moreover the volume deals with all aspects of microbial degradation ranging from screening methods for the degradative microorganisms processes of degradation strain improvement for enhanced biodegradation and elimination of undesirable compounds to improving health and environmental protection strategies The book will provide an opportunity for scientists in the areas of microbiology biochemistry engineering food science biotechnology and environmental science to obtain a clear understanding of microbial biotransformations of xenobiotics as well as an interface between industry and the academic world The first book of its kind it will open new vistas of research in the field of Applied Microbiology and Biotechnology in general and Biotransformations in particular **Development in Wastewater Treatment Research and Processes** Maulin P. Shah, Susana

Rodriguez-Couto, 2022-02-18 Development in Wastewater Treatment Research and Processes Microbial Degradation of Xenobiotics through Bacterial and Fungal Approach covers the active and applicable role that bacteria and fungi play in the degradation of xenobiotic compounds from the environment The book gives up to date information on recent advancements in the field of environmental xenobiotics and how they disturb a plant's metabolism The book also gives information on aerobic and anaerobic degradation of xenobiotic compounds through bacteria or fungi and or a combined approach Finally the book covers the characteristics of environmental microbiology biochemical engineering agricultural microbiology environmental engineering and soil bioremediation Emphasizes up to date research on the microbial degradation of xenobiotic compounds through a bacterial fungal approach Covers multidisciplinary features of environmental microbiology biochemical engineering agriculture microbiology environmental engineering and soil bioremediation Includes sections on aerobic and anaerobic degradation Presents the significance of the bacterial fungal role and their metabolic activities in the digestion of xenobiotic compounds Focuses on the most recent developments in environmental biotechnology to enhance the action of the bacterial fungal systems in the remediation of xenobiotic compounds *The Role of Microalgae in Wastewater*

*Treatment* Lala Behari Sukla, Enketeswara Subudhi, Debabrata Pradhan, 2018-11-03 This book deals with the most emerging aspects of algal research with special reference to microalgae viz diversity mutations genomics and metagenomics study eco physiology culturing microalgae for food and feed biofuel production harvesting of microalgae separation and purification of biochemicals techno economical assessment microalgal biotechnology algal bacterial systems for wastewater treatment It describes the complex issues associated with the above mentioned areas with the intervention of cutting edge biotechnological tools and techniques like next generation sequencing methods metabolomics and bioreactor design and development The chapters provide past developments current information and future prospects of algal technology as an alternate avenue for waste water treatment and its potential for production of biofuel and nutraceuticals *Smart Bioremediation Technologies* Pankaj Bhatt, 2019-06-07 Smart Bioremediation Technologies Microbial Enzymes provides insights into the complex behavior of enzymes and identifies metabolites and their degradation pathways It will help readers work towards solutions for sustainable medicine and environmental pollution The book highlights the microbial enzymes that have replaced many plant and animal enzymes also presenting their applications in varying industries including pharmaceuticals genetic engineering biofuels diagnostics and therapy In addition new methods including genomics and metagenomics are being employed for the discovery of new enzymes from microbes This book brings all of these topics together representing the first resource on how to solve problems in bioremediation Provides the most novel approaches in enzyme studies Gives insights in real time enzymology that are correlated with bioremediation Serves as a valuable resource on the use of genomes transcriptomes and proteomes with bioremediation Refers to enzymes as diagnostic tools

**Management of Soil Problems** Khan Towhid Osman, 2018-05-03 Soils are neither good nor bad but some have inherent or acquired characteristics that may or may not suit our intended use Unsuitable characteristics are considered to be soil problems soil constraints or soil limitations Only twelve percent of global land is right for agricultural production without much limitation Some soils have severe limitations for crop production These soils are so called problem soils Many of them do not have enough fertility to be productive some are arid and saline some are very sandy and dry and some are wet and waterlogged for most of the growing season The global demand for food wood fuel fiber medicine and other plant products for the 7.2 billion current world population has created such an immense pressure on global soil resources that even the most fertile soils are losing their productive capacity We are being compelled to bring more and more unsuitable or marginally suitable soils under cultivation Unless innovative and integrated soil crop and environmental management practices are adopted for their improvement and sustainable use further degradation is inevitable This book Management of Soil Problems identifies the problems and discusses management options in a smooth and reader friendly style It will be useful for students and professionals of soil science agriculture forestry geography and environmental sciences **Marine Carbohydrates: Fundamentals and Applications, Part B**, 2014-10-01 Marine Carbohydrates Fundamentals and Applications brings



together the diverse range of research in this important area which leads to clinical and industrialized products The volume number 73 focuses on marine carbohydrates in isolation biological and biomedical applications and provides the latest trends and developments on marine carbohydrates Advances in Food and Nutrition Research recognizes the integral relationship between the food and nutritional sciences and brings together outstanding and comprehensive reviews that highlight this relationship Volumes provide those in academia and industry with the latest information on emerging research in these constantly evolving sciences Includes the isolation techniques for the exploration of the marine habitat for novel polysaccharides Discusses biological applications such as antioxidant antiallergic antidiabetic antiobesity and antiviral activity of marine carbohydrates Provides an insight into present trends and approaches for marine carbohydrates

*Bioremediation and Phytoremediation Technologies in Sustainable Soil Management* Junaid Ahmad Malik, Megh R. Goyal, Khursheed Ahmad Wani, 2022-06-30 This 4 volume set focuses on the use of microbial bioremediation and phytoremediation to clean up pollutants in soil such as pesticides petroleum hydrocarbons metals and chlorinated solvents which reduce the soil's fertility and renders it unfit for plant growth The volumes cover the many diverse eco friendly microbial bioremediation and phytoremediation techniques for sustainable soil management Volume 4 Degradation of Pesticides and Polychlorinated Biphenyls addresses pesticide degradation PCBs degradation and genetic interventions It begins by describing environmental pesticide degradation mechanisms and sustainability microbes and microbial enzymes plant microbe interactions organophosphorus degradations and endosulfan degradation It then goes on to discuss PCBs and degradation cypermethrin degradation by *Phanerochaete chrysosporium* and carvone and surfactants for degradation of PCBs The book also advocates for genetic systems for degradation of PCBs and pesticides with discussion of the different advantages and disadvantages for each strategy and the various techniques Other volumes in the 4 volume set Volume 1 Fundamental Aspects and Contaminated Sites Volume 2 Microbial Approaches and Recent Trends Volume 3 Inventive Techniques Research Methods and Case Studies Together these four volumes provide in depth coverage of the mechanisms advantages and disadvantages of the bioremediation and phytoremediation technologies for safe and sustainable soil management

**Progress in Environmental Science and Engineering (ICEESD)** He Xing Li, Qun Jie Xu, Da Quan Zhang, 2011-10-07 Selected peer reviewed papers from the 2011 International Conference on Energy Environment and Sustainable Development ICEESD 2011 October 21-23 2011 Shanghai China Biodegradation and Bioremediation Ajay Singh, Owen P. Ward, 2013-03-09 In this volume experts from universities government labs and industry share their findings on the microbiological biochemical and molecular aspects of biodegradation and bioremediation The text covers numerous topics including bioavailability biodegradation of various pollutants microbial community dynamics properties and engineering of important biocatalysts and methods for monitoring bioremediation processes Microbial processes are environmentally compatible and can be integrated with non biological processes to detoxify degrade and immobilize

environmental contaminants

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