

Bioelectrochemical Systems From Extracellular Electron Transfer To Biotechnological Application Integrated Environmental Technology

Innovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment
 Microbial Extracellular Electron Transfer
 The Autotrophic Biorefinery
 Waste to Wealth
 Wastewater Treatment
 Microbial Community and Electrochemistry of Bioelectrochemical Systems
 Electron-Based Bioscience and Biotechnology
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MIYA JOHN

Innovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment CRC Press

This volume presents the fundamentals and advances in state-of-the-art catalytic nanoscale interventions to improve the efficiency of bioelectrochemical systems. These systems are used in a number of applications in the water-energy nexus.

Contributed chapters describe and build on useful strategies to use and reference when dealing with an important environmental issue: the final disposal of heavy metal catalysts. Summarizing basic and translational research, these chapters are valuable for researchers in energy, nanotechnology, and catalysis.
Microbial Extracellular Electron Transfer
 Springer
 The depletion of fossil resources and an ever-growing human population create an increasing demand for the development of sustainable processes for the utilization of renewable resources. As autotrophic microorganisms offer numerous metabolic pathways for the fixation of carbon dioxide

and the metabolic utilization of light, electricity and inorganic energy donors, they are expected to play a pivotal role in an emerging carbon neutral society. This text-book presents the metabolic principles of autotrophy and current efforts for their utilization in biotechnology, including photoautotrophic, chemolithoautotrophic and electroautotrophic organisms. It outlines how modern molecular biology and process engineering create technologies that allow to use industrial off-gases and inorganic energy for the synthesis of bio-based plastics, materials and other chemical products. The text-book is ideally suited for students in advanced graduate

and master courses and offers a reference for PhD students, engineers, chemists, biologists and all with an interests in biotechnology and renewable resources.

The Autotrophic Biorefinery Springer Science & Business Media

The European project MINOTAURUS explored innovative bio-processes to eliminate emerging and classic organic pollutants. These bio-processes are all based on the concept of immobilization of biocatalysts (microorganisms and enzymes) and encompass bioaugmentation, enzyme technology, rhizoremediation with halophytes, and a bioelectrochemical remediation process. The immobilization-based technologies are applied as engineered ex situ treatment systems as well as natural systems in situ for the bioremediation of groundwater, wastewater and soil. The selection and application of tailored physico-chemical, molecularbiological and ecotoxicological monitoring tools combined with a rational understanding of engineering, enzymology and microbial physiology is a pertinent approach to open the black-box of the selected technologies. Reliable process monitoring constitutes the basis for developing and refining biodegradation kinetics models, which in turn improve the predictability of performances to be achieved with technologies. Immobilised Biocatalysts for Bioremediation of Groundwater and Wastewater delivers insight into the concepts and performance of a series of remediation approaches. A key strength of this book is to deliver results from lab-scale through to piloting at different European reference sites. It further suggests frameworks for structuring and making evidence-based decisions for the most appropriate bioremediation measures.

Waste to Wealth Springer Nature

This thesis presents studies that examine microbial extracellular electron transfer that an emphasis characterizing how environmental conditions influence electron flux between microbes and a solid-phase electron donor or acceptor. I used bioelectrochemical systems (BESs), fluorescence and electron microscopy, chemical measurements, 16S rRNA analysis, and qRT-PCR to study these relationships among chemical, physical and biological parameters and processes.

Wastewater Treatment John Wiley & Sons

Introduces basic principles and mechanisms, covers new developments, and provides a different view of the main facets of bioelectrosynthesis Bioelectrosynthesis represents a promising approach for storing renewable energy or

producing target chemicals in an energy-sustainable and low-cost way. This timely and important book systemically introduces the hot issues surrounding bioelectrosynthesis, including potential value-added products via bioelectrochemical system, reactor development of bioelectrosynthesis, and microbial biology on biofilm communities and metabolism pathways. It presents readers with unique viewpoints on basic principles and mechanisms along with new developments on reactor and microbial ecology. Beginning with a principle and products overview of bioelectrosynthesis, Bioelectrosynthesis: Principles and Technologies for Value-Added Products goes on to offer in-depth sections on: biogas production and upgrading technology via bioelectrolysis; organic synthesis on cathodes; chemical products and nitrogen recovery; external electron transfer and electrode material promotion; and the microbiology of bioelectrosynthesis. Topics covered include: hydrogen production from waste stream with microbial electrolysis cell; microbial electrolysis cell; inorganic compound synthesis in bioelectrochemical system; microbial growth, ecological, and metabolic characteristics in bioelectrosynthesis systems; microbial metabolism kinetics and interactions in bioelectrosynthesis system; and more. * Comprehensively covers all of the key issues of bioelectrosynthesis * Features contributions from top experts in the field * Examines the conversion of organic wastes to methane via electromethanogenesis; methane production at biocathodes; extracellular electron transport of electroactive biofilm; and more Bioelectrosynthesis: Principles and Technologies for Value-Added Products will appeal to chemists, electrochemists, environmental chemists, water chemists, microbiologists, biochemists, and graduate students involved in the field.

John Wiley & Sons

Current research fields in science and technology were presented and discussed at the EKC2008, informing about the interests and directions of the scientists and engineers in EU countries and Korea. The Conference has emerged from the idea of bringing together EU and Korea to get to know each other better, especially in fields of science and technology. The focus of the conference is put on the topics: Computational Fluid Dynamics, Mechatronics and Mechanical Engineering, Information and Communications Technology, Life and Natural Sciences, Energy and Environmental Technology.

Microbial Community and Electrochemistry of Bioelectrochemical Systems IWA

Publishing

This book encompasses the most updated and recent account of research and implementation of Microbial Electrochemical Technologies (METs) from pioneers and experienced researchers in the field who have been working on the interface between electrochemistry and microbiology/biotechnology for many years. It provides a holistic view of the METs, detailing the functional mechanisms, operational configurations, influencing factors governing the reaction process and integration strategies. The book not only provides historical perspectives of the technology and its evolution over the years but also the most recent examples of up-scaling and near future commercialization, making it a must-read for researchers, students, industry practitioners and science enthusiasts. Key Features: Introduces novel technologies that can impact the future infrastructure at the water-energy nexus. Outlines methodologies development and application of microbial electrochemical technologies and details out the illustrations of microbial and electrochemical concepts. Reviews applications across a wide variety of scales, from power generation in the laboratory to approaches. Discusses techniques such as molecular biology and mathematical modeling; the future development of this promising technology; and the role of the system components for the implementation of bioelectrochemical technologies for practical utility. Explores key challenges for implementing these systems and compares them to similar renewable energy technologies, including their efficiency, scalability, system lifetimes, and reliability.

Electron-Based Bioscience and Biotechnology CRC Press

Wastewater Treatment: Cutting-Edge Molecular Tools, Techniques and Applied Aspects reports new findings in existing molecular biology strategies, including their limitations, challenges and potential application to remove environmental pollutants through advancements made in cutting edge tools. In addition, the book introduces new trends and advances in environmental bioremediation with thorough discussions on recent developments in this field. Describes the application of different omics tools in wastewater treatment plants (WWTPs) Describes the role of microorganisms in WWTPs Points out the reuse of treated wastewater through emerging

technologies Includes the recovery of resources from wastewater Emphasizes the need for the use of cutting-edge molecular tools
Principles and Technologies for Value-Added Products Springer
 The increasing demand for energy worldwide, currently evaluated at 13 terawatts per year, has triggered a surge in research on alternative energy sources more sustainable and environmentally friendly. Bio-catalyzed electrochemical systems (BESs) are a rapidly growing biotechnology for sustainable production of bioenergy and/or value-added bioproducts using microorganisms as catalysts for bioelectrochemical reactions at the electrode surface. In the last decades, this biotechnology has been intensively studied and developed as a flexible and practical platform for multiple applications such as electricity production, wastewater treatment, pollutants remediation, desalination and production of biogas, biofuels, or other commodities. BESs could have a critical impact on societies in many spheres of activity and become one of the solutions to reform our petroleum-based economy. However, BESs research has so far been limited to lab scale with the notable exceptions of pilot scale microbial fuel cells for brewery and winery wastewater treatment coupled with electricity generation. In general, more knowledge has to be acquired to overcome the issues that are stymieing BESs development and commercialization. For example, it is critical to understand better microbial physiology including the mechanisms responsible for the transfer of electrons between the microbes and the electrodes to start optimizing the systems in a more rational manner. There are many BES processes and for each one of them there is a multitude of biological and electrochemical specifications to investigate and adjust such as the nature of the microbial platform, electrode materials, the reactor design, the substrate, the medium composition, and the operating conditions. The ultimate goal is to develop highly energy efficient BESs with a positive footprint on the environment while maintaining low cost and generating opportunities to create value. BESs are complex systems developed with elements found in multiple fields of science such as microbiology, molecular biology, bioinformatics, biochemistry, electrochemistry, material science and environmental engineering. Given the high volume of research activities going on in the field of BESs today, this e-book explores the current challenges, the more recent progresses,

and the future perspectives of BESs technologies. The BESs discussed here include microbial fuel cells, microbial electrolysis cells, microbial electrosynthesis cells, microbial electroremediation cells, etc.
From Extracellular Electron Transfer to Biotechnological Application Elsevier
 Nitrogen containing compounds produced by industrial processes are pollutants which pose a significant environmental and health hazard. There are a number of processes that have been devised for removing nitrogen compounds from wastewater. This reference book summarizes different denitrification methods for wastewater processing. The book introduces readers to toxic nitrogen compounds responsible for water pollution. This introduction is followed by chapters which explain different nitrogen removal methods including conventional methods, biological methods, food industry wastewater treatment and new approaches towards environmental pollution remediation: Bio Electrochemical Systems (BESs). This book is a handy reference guide for industrial and environmental engineers and students learning about wastewater management and industrial denitrification.
Microbial Dissimilatory Nitrate Reduction in Bioelectrochemical Systems with Electrode-respiring Biofilms and Wastewater Treatment Processes CRC Press
 Microbial electrochemical systems (MESs, also known as bioelectrochemical systems (BESs) are promising technologies for energy and products recovery coupled with wastewater treatment, and have attracted increasing attention. Many studies have been conducted to expand the application of MESs for contaminants degradation and bioremediation, and increase the efficiency of electricity production by optimizing architectural structure of MESs, developing new electrode materials, etc. However, one of the big challenges for researchers to overcome, before MESs can be used commercially, is to improve the performance of the biofilm on electrodes so that 'electron transfer' can be enhanced. This would lead to greater production of electricity, energy or other products. Electrochemically active microorganisms (EAMs) are a group of microorganisms which are able to release electrons from inside their cells to an electrode or accept electrons from an electron donor. The way in which EAMs do this is called 'extracellular electron transfer' (EET). So far, two EET mechanisms have been identified: direct

electron transfer from microorganisms physically attached to an electrode, and indirect electron transfer from microorganisms that are not physically attached to an electrode. 1) Direct electron transfer between microorganisms and electrode can occur in two ways: a) when there is physical contact between outer membrane structures of the microbial cell and the surface of the electrode, b) when electrons are transferred between the microorganism and the electrode through tiny projections (called pili or nanowires) that extend from the outer membrane of the microorganism and attach themselves to the electrode. 2) Indirect transfer of electrons from the microorganisms to an electrode occurs via long-range electron shuttle compounds that may be naturally present (in wastewater, for example), or may be produced by the microorganisms themselves. The electrochemically active biofilm, which degrades contaminants and produces electricity in MESs, consists of diverse community of EAMs and other microorganisms. However, up to date only a few EAMs have been identified, and most studies on EET have focused on the two model species of *Shewanella oneidensis* and *Geobacter sulfurreducens*.
Nitrogen Removal Processes for Wastewater Treatment IWA Publishing
 In the context of wastewater treatment, Bioelectrochemical Systems (BESs) have gained considerable interest in the past few years, and several BES processes are on the brink of application to this area. This book, written by a large number of world experts in the different sub-topics, describes the different aspects and processes relevant to their development. Bioelectrochemical Systems (BESs) use micro-organisms to catalyze an oxidation and/or reduction reaction at an anodic and cathodic electrode respectively. Briefly, at an anode oxidation of organic and inorganic electron donors can occur. Prime examples of such electron donors are waste organics and sulfides. At the cathode, an electron acceptor such as oxygen or nitrate can be reduced. The anode and the cathode are connected through an electrical circuit. If electrical power is harvested from this circuit, the system is called a Microbial Fuel Cell; if electrical power is invested, the system is called a Microbial Electrolysis Cell. The overall framework of bio-energy and bio-fuels is discussed. A number of chapters discuss the basics - microbiology, microbial ecology, electrochemistry, technology and materials development. The book continues by highlighting the plurality of processes based on BES

technology already in existence, going from wastewater based reactors to sediment based bio-batteries. The integration of BESs into existing water or process lines is discussed. Finally, an outlook is provided of how BES will fit within the emerging biorefinery area.

Characteristics, Analysis and Control IWA Publishing

This book focuses on value addition to various waste streams, which include industrial waste, agricultural waste, and municipal solid and liquid waste. It addresses the utilization of waste to generate valuable products such as electricity, fuel, fertilizers, and chemicals, while placing special emphasis on environmental concerns and presenting a multidisciplinary approach for handling waste. Including chapters authored by prominent national and international experts, the book will be of interest to researchers, professionals and policymakers alike.

Principles and Technologies for Value-Added Products IWA Publishing

This book offers a comprehensive introduction to electron-based bioscience, biotechnology, and biocorrosion. It both explains the importance of electron flow during metabolic processes in microorganisms and provides valuable insights into emerging applications in various fields. In the opening section, readers will find up-to-date information on topics such as electron transfer reactions, extracellular electron transfer mechanisms, direct interspecies electron transfer, and electron uptake by sulfate-reducing bacteria. The focus then shifts to state-of-the-art advances and applications in the field of biotechnology. Here, the coverage encompasses e.g. progress in understanding electrochemical interactions between microorganisms and conductive particles, enzymatic reactions and their application in the bioproduction of useful chemicals, and the importance of redox balance for fatty acid production. In closing, the book addresses various aspects of the complex phenomenon of microbiologically induced corrosion, highlighting novel insights from the fields of electromicrobiology and electrochemistry and their implications.

Environmental Technologies to Treat Sulfur Pollution Elsevier

This book presents the state of the art technologies and solutions to tackle the critical challenges faced by the building and development of the WSN and ecological monitoring system but also potential impact on society at social, medical and technological level. This book is dedicated to Sensing systems for

Sensors, Wireless Sensor Networks and Ecological Monitoring. The book aims at Master and PhD degree students, researchers, practitioners, especially WSN engineers involved with ecological monitoring. The book will provide an opportunity of a dedicated and a deep approach in order to improve their knowledge in this specific field.

Techniques and Case Studies for Environmental Pollution Springer Science & Business Media

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 insilico 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.

Fundamentals and Applications Springer. Expert authors provide critical, in-depth reviews of available methods for retrieving selective information out of complex biological systems. Sensors, probes and devices are present and future tools of medicinal diagnostics, environmental monitoring, food analysis and molecular biology. These are based on fluorescence, electrochemistry and mass spectrometry. Coverage of this volume includes sensor development for the detection of small analytes, monitoring of biomolecular interactions, analysis of cellular function, development of diagnostic tools.

Current Challenges and Future Perspectives on Emerging Bioelectrochemical Technologies

Bioelectrochemical Systems From Extracellular Electron Transfer to Biotechnological Application Environmental Technologies to Treat Sulfur Pollution: Principles and Engineering provides a definitive and detailed discussion of state-of-the-art environmental technologies to treat pollution by sulfurous compounds of wastewater, off-gases, solid waste, soils and sediments. Special attention is given to novel bioremediation techniques that have been developed over the last 10 years. Information density is unique owing to the many figures and graphs (150), tables (over 80) and over 1500 cited literature references. A detailed subject index helps the reader to find their way through the different technological applications, making it the perfect reference work for professionals and consultants dealing with sulfur-related environmental (bio)-technologies.

Cutting-Edge Molecular Tools, Techniques and Applied Aspects John Wiley & Sons

This book reviews the latest advances in the bioelectrochemical degradation of recalcitrant environmental contaminants. The first part introduces readers to the basic principles and methodologies of bioelectrochemical systems, electron-respiring microorganisms, the electron transfer mechanism and functional electrode materials. In turn, the second part addresses the bioelectrochemical remediation/treatment of various environmental pollutants (including highly toxic refractory organics, heavy metals, and nitrates) in wastewater, sediment and wetlands. Reactor configuration optimization, hybrid technology amplification and enhanced removal principles and techniques are also discussed. The book offers a valuable

resource for all researchers and professionals working in environmental science and engineering, bioelectrochemistry, environmental microbiology and biotechnology. [Bioelectrochemical Systems Elsevier](#) This contributed volume sheds new light on waste management and the production of biofuels. The authors share insights into

microbial applications to meet the challenges of environmental pollution and the ever- growing need for renewable energy. They also explain how healthy and balanced ecosystems can be created and maintained using strategies ranging from oil biodegradation and detoxification of azo dyes to biofouling. In addition, the book illustrates how the metabolic abilities of

microorganisms can be used in microbial fuel-cell technologies or for the production of biohydrogen. It inspires young researchers and experienced scientists in the field of microbiology to explore the application of green biotechnology for bioremediation and the production of energy, which will be one of the central topics for future generations.

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