

Biosensoric potential of microbial fuel cells

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Abstract Recent progress in microbial fuel cell (MFC) technology has highlighted the potential of these devices to be used as biosensors. The advantages of MFC-based biosensors are that they are phenotypic and can function in either assay- or flow-through formats. These features make them appropriate for continuous on-line monitoring in laboratories and for in-field applications. The selectivity of an MFC biosensor depends on the applied microorganisms in the anodic compartment where electron transfer (ET) between the artificial surface (anode) and bacterium occurs. This process strongly determines the internal resistance of the sensoric system and thus influences signal outcome and response time. Despite their beneficial characteristics, the number of MFC-based biosensoric applications has been limited until now. The aim of this mini-review is to turn attention to the biosensoric potential of MFCs by summarizing ET mechanisms on which recently established and future sensoric devices are based.

Keywords MFC · Biosensor · Electron transfer · Phenotypic · On-line · Diagnostic

Introduction

Rapid recognition of the presence or effect of toxic compounds is a major challenge in several fields of biology and medicine. Traditional methods have been principally developed for environmental applications and with their help, soil and water samples can be screened for pollutants such as cadmium, arsenic, etc. (Aas et al. 2009). These chemical methods perform adequately in laboratories with special instrumentation, but the application of biosensors, enzymes from living cells or living organisms themselves, offer efficient solutions for toxic compound detection. Traditional procedures apply macroscopic (fish and daphnia) or microscopic (algae and bacteria) organisms (Weyers et al. 2000). Due to several advantageous features, microbes offer promising platforms for bio-sensing since (i) they are selective: they show a broad spectrum of resistance or sensitivity toward different toxic compounds, (ii) they can metabolize a wide range of chemical compounds, (iii) they are simple to cultivate and are able to thrive under adverse conditions, (iv) they are sensitive to analytes in a highly specific manner, and (v) they are amenable to recombinant DNA technologies (D'Souza 2001). Based on this plasticity, several microbial biosensoric technologies and applications were developed and recently summarized (Dai and Choi 2013). One among them is the microbial fuel cell (MFC)-based technology.

MFCs are electrochemical devices that can convert chemical energy by biological tools into electricity in the presence of organic substrates (Bennetto 1990). MFCs consist of a cathodic and anodic space in double-chamber or single-chamber configuration (Logan et al. 2006). Besides their promising

The present scientific contribution is dedicated to the 650th anniversary of the foundation of the University of Pécs, Hungary.

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Dr. Samta Shukla



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Fundamentals of Biosensors in Healthcare Md Saquib Hasnain, Amit Kumar Nayak, Tejraj M. Aminabhavi, 2024-11-23
Fundamentals of Biosensors in Healthcare Volume One provides comprehensive coverage on fundamentals while also delving into the diverse types of biosensors used in healthcare This first of three volumes covers biosensors in healthcare and explains the history classifications and fundamentals of biosensing It presents current research and the development of biosensors while also exploring and detailing the distinct types of biosensors and their application in healthcare Combined with Volume Two Materials and Components of Biosensors in Healthcare and Volume Three Applications of Biosensors in Healthcare users will find a holistic set of reference sources that are suitable for researchers graduate students postgraduates and industry professionals involved in biosensing biosensors and biomedical applications Provides information on the basic principles and types of biosensors used in healthcare Examines current research potential challenges and future prospects for biosensor technologies Contributed by global leaders and experts in the field from academia research and industry

Fundamentals of Conjugated Polymer Blends, Copolymers and Composites Parveen Saini, 2015-04-30
Since their discovery in 1977 the evolution of conducting polymers has revolutionized modern science and technology These polymers enjoy a special status in the area of materials science yet they are not as popular among young readers or common people when compared to other materials like metals paper plastics rubber textiles ceramics and composites like concrete Most importantly much of the available literature in the form of papers specific review articles and books is targeted either at advanced readers scientists technologists engineers senior academicians or for those who are already familiar with the topic doctoral postdoctoral scholars For a beginner or even school college students such compilations are bit difficult to access digest In fact they need proper introduction to the topic of conducting polymers including their discovery preparation properties applications and societal impact using suitable examples and already known principles knowledge phenomenon Further active participation of readers in terms of question answers fill in the blanks numerical along with suitable answer key is necessary to maintain the interest and to initiate the thought process The readers also need to know about the drawbacks and any hazards of such materials Therefore I believe that a comprehensive source on the science technology of conducting polymers which maintains a link between grass root fundamentals and state of the art R D is still missing from the open literature

Biosensors Chandra Mouli Pandey, Bansi Dhar Malhotra, 2019-03-04 This book focuses on the state of the art of biosensor research and development for specialists and non specialists It introduces the fundamentals of the subject with relevant characteristics of transducer elements as well as biochemical recognition molecules This book is ideal for researchers of nanotechnology materials science and biophysics

Advances in Biosensing Technology for Medical Diagnosis Han-Sheng Chuang, Yi-Ping Ho, 2020-10-14 Biosensing technology is rapidly flourishing in recent years due to the advancement of bio MEMS NEMS However the booming development of biosensors has not been very well addressed to the

unmet clinical needs Advances in Biosensing Technology for Medical Diagnosis initiates a headway into the realm of cutting edge diagnostic tools which are expected to become routine clinical practice This book aims to broaden the readers horizon and guide them in tailoring different biosensing techniques for specific diagnostic procedures Key Features 12 chapters cover several aspects of biosensing technologies including working principles and clinical validations highlights the state of the art biosensing technology developed in all fields provides information about specific applications of novel biosensors used in clinical diagnosis provides step by step guidance of microfabrication for biosensors focuses on bridging the gap between the scientific and the clinical communities provides information about the diagnostic applications of biosensors for different diseases including infectious diseases and neurodegenerative diseases covers Information about unconventional nano microfluidic biosensor systems features contributions from renowned experts in the field of biomedical engineering Advances in Biosensing Technology for Medical Diagnosis serves as a reference for healthcare providers and biomedical engineers who are interesting in biosensing techniques in medicine The information provided in this reference will also benefit healthcare policymakers who are interested in new technologies that can impact the delivery of diagnostic services in healthcare systems

Biosensors Toonika Rinken, 2015-09-24 Nowadays the implementation of novel technological platforms in biosensor based developments is primarily directed to the miniaturization of analytical systems and lowering the limits of detection Rapid scientific and technological progress enables the application of biosensors for the online detection of minute concentrations of different chemical compounds in a wide selection of matrixes and monitoring extremely low levels of biomarkers even in living organisms and individual cells This book including 16 chapters characterizes the present state of the art and prospective options for micro and nanoscale activities in biosensors construction and applications Innovations in Green Nanoscience and Nanotechnology Shrikaant Kulkarni, 2022-12-21 This book discusses how greener synthetic pathways are amenable and productive for the synthesis of novel nanomaterials It furthers the integration of advances in green nanoscience and nanotechnology including pathways dedicated to the design development and fabrication of a range of products and devices Topics such as green nanotechnology for advanced energy systems sustainable delivery systems medicine agri nanotechnology for sustainable agriculture nanotechnology in crop protection and nanotechnology for soil conservation are included FEATURES Provides a holistic view of green nanotechnology and its applications Places an emphasis on synthesis characterization and applications of green nanomaterials Discusses the development of innovative green synthetic pathways to produce novel biomaterials Includes characterization tools used in the material synthesis via green synthetic pathways Advocates green nanotechnology solutions for sustainability and energy This book is aimed at researchers and professionals in nanotechnology green chemistry and chemical engineering

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

Handbook of Biosensors Technology Sümeyra SAVAŞ, 2025-02-14 *Nanosensors* Dimitrios Nikolelis, Georgia Paraskevi

Nikoleli, 2023-04-03 Nanotechnology and biosensors show how nanotechnology is used to create affordable mass produced portable small sized nanosensors to directly monitor food toxicants and environmental pollutants In addition it provides the market with systems for applications in food analysis environmental monitoring and health diagnostics Nanotechnology has led to a dramatic improvement in the performance sensitivity and selectivity of biosensor devices Metal oxides and carbon nanostructures gold and magnetite nanoparticles and the integration of dendrimers in biosensors using nanotechnology have contributed greatly to making nanosensors more effective and affordable in the market This book provides a timely resource on the subject

Nanovaccinology Kaushik Pal, 2023-08-22 This book provides an overview of the cumulative work on a driving force for innovation in medicine and modern healthcare boosting advances in therapeutics biosensors vaccines and clinical systems The work presented shows how nanoparticles have been investigated as vaccine adjuvants because they possess chemical and structural properties that improve immunogenicity as well as the use of nanotechnology in the construction of immunization systems that has developed into the field of viral nanovaccinology The volume highlights potential areas of research innovation and development of finished products for future commercialization and significant research exploration through nanoparticles that prove capable of surmounting most of the barriers like toxicity issues clearance from biological system DNA instability and differences in expression systems The contributing authors review the primary literature on principles limitations and recent breakthroughs in nanoparticle based antigen delivery vehicles their use in different diseases the major bottlenecks and related issues Highlighting advances in nanoparticle engineering and the understanding of nanoparticle characteristics as well as critical legacy work done in the field of nanobiotechnology the book

is ideal for a range of researchers and students in the pure and applied sciences devoted to nanomaterials vaccinology and translational medicine

Innovative Methods in Horticultural Crop Improvement Jameel M. Al-Khayri, Lina M. Alnaddaf, Shri Mohan Jain, Suprasanna Penna, 2024-09-20 This book focuses on recent advances in biosensors and nanosensors to monitor manage and improve horticultural crops in terms of plant growth nutrient deficiency toxicity diseases abiotic stress soil amendments and agrochemicals entry into surrounding environment Besides contributing to sustainable agriculture these innovative tools facilitate promoting plant health and horticultural products quality and safety The book consists of 11 chapters grouped in 4 parts Part I Growth Development and Productivity Part II Trends in Abiotic and Biotic Stress Management Part III Harvest Quality Part IV Precision Agriculture and Environment Sustainability Increased productivity stimulation of plant growth precise farming monitoring food quality and freshness during production processing distribution and storage reduced costs and waste and sustainable agriculture are some of the concepts discussed The book presents the mechanisms of biosensors and nanosensors for monitoring the various changes during pre and post harvest stages of horticultural crops These are considered as efficient tools to achieve goals of plant breeders in horticultural crops improvement programs Chapters are written by globally recognized scientists and subjected to a rigorous review process to ensure quality presentation and scientific precision Each chapter begins with an introduction that covers similar contexts and includes a detailed discussion of the topic accompanied by high quality color images diagrams and relevant details and concludes with recommendations for future study directions in addition to a comprehensive bibliography

Biosensors Based on Nanomaterials and Nanodevices Jun Li, Nianqiang Wu, 2017-12-19 Biosensors Based on Nanomaterials and Nanodevices links interdisciplinary research from leading experts to provide graduate students academics researchers and industry professionals alike with a comprehensive source for key advancements and future trends in nanostructured biosensor development It describes the concepts principles materials device fabrications functions system integrations and applications of various types of biosensors based on signal transduction mechanisms including fluorescence photonic crystal surface enhanced Raman scattering electrochemistry electro luminescence field effect transistor and magnetic effect The book Explains how to utilize the unique properties of nanomaterials to construct nanostructured biosensors to achieve enhanced performance Features examples of biosensors based on both typical and emerging nanomaterials such as gold nanoparticles quantum dots graphene graphene oxides magnetic nanoparticles carbon nanotubes inorganic nanowires nanorods plasmonic nanostructures and photonic crystals Demonstrates the broad applications of nanostructured biosensors in environmental monitoring food safety industrial quality assurance and in vitro and in vivo health diagnosis Inspires new ideas for tackling multiscale and multidisciplinary issues in developing high performance biosensors for complex practical biomedical problems Focusing on the connection between nanomaterials research and biosensor development Biosensors Based on Nanomaterials and Nanodevices illustrates the exciting possibilities and critical challenges of biosensors based on

nanomaterials and nanodevices for future health monitoring disease diagnosis therapeutic treatments and beyond

Nanowires Ram K. Gupta, 2023-03-14 This comprehensive resource covers the fundamentals of synthesis characterizations recent progress and applications of nanowires for many emerging applications Early chapters address their unique properties and morphology that enable their electronic optical and mechanical properties to be tuned Later chapters address future perspectives and future challenges in areas where nanowires could provide possible solutions All chapters are written by global experts making this a suitable textbook for students and an up to date handbook for researchers and industry professionals working in physics chemistry materials energy biomedical and nanotechnology Covers materials chemistry and technologies for nanowires Covers the state of the art progress and challenges in nanowires Provides fundamentals of the electrochemical behavior of various electrochemical devices and sensors Offers insights on tuning the properties of nanowires for many emerging applications Provides a new direction and understanding to scientists researchers and students

Encyclopedia of Food Microbiology Carl A. Batt, 2014-04-02 Written by the world's leading scientists and spanning over 400 articles in three volumes the Encyclopedia of Food Microbiology Second Edition is a complete highly structured guide to current knowledge in the field Fully revised and updated this encyclopedia reflects the key advances in the field since the first edition was published in 1999 The articles in this key work heavily illustrated and fully revised since the first edition in 1999 highlight advances in areas such as genomics and food safety to bring users up to date on microorganisms in foods Topics such as DNA sequencing and E coli are particularly well covered With lists of further reading to help users explore topics in depth this resource will enrich scientists at every level in academia and industry providing fundamental information as well as explaining state of the art scientific discoveries This book is designed to allow disparate approaches from farmers to processors to food handlers and consumers and interests to access accurate and objective information about the microbiology of foods Microbiology impacts the safe presentation of food From harvest and storage to determination of shelf life to presentation and consumption This work highlights the risks of microbial contamination and is an invaluable go to guide for anyone working in Food Health and Safety Has a two fold industry appeal 1 those developing new functional food products and 2 to all corporations concerned about the potential hazards of microbes in their food products

Biomedical Diagnostic Science Wai Tak Law, Naim Akmal, Arthur Usmani, 2002-07-30 Examines developments in gene and biochips Biomedical Diagnostic Science and Technology comprehensively discusses new signals for analyte detection site directed immobilization of proteins methods to improve surface biocompatibility current strategies for the treatment of diabetes t

Gas Sensing Fundamentals Claus-Dieter Kohl, Thorsten Wagner, 2014-08-18 This volume which addresses various basic sensor principles covers micro gravimetric sensors semiconducting and nano tube sensors calorimetric sensors and optical sensors Furthermore the authors discuss recent developments in the related sensitive layers including new properties of nano structured metal oxide layers They provide in depth insights into the unique chemistry and

signal generation of copper oxide in percolating sensors and present a variety of applications of functional polymers made possible by proper imprinting Highlights of the subjects covered include requirements for high temperature sensors carbon nano tube sensors new sensing model for nanostructured In₂O₃ bio mimetic approach for semiconductor sensor based systems optical readout for inorganic and organic semiconductor sensors concept of virtual multisensors to improve specificity and selectivity calorimetric sensors for hydrogen peroxide detection percolation effect based sensors to implement dosimeters imprinted polymer layers for bulk and surface acoustic wave sensors

Fundamentals of Microbiology: Concepts and Applications Dr. Santa Shukla, 2025-06-09 Fundamentals of Microbiology Concepts and Applications is an academic textbook developed to provide students with a clear concise and complete understanding of microbiology Covering a wide range of topics from microbial structure and genetics to their practical applications in health industry and the environment the book is structured to cater to undergraduate learners and entry level researchers The book is divided into eight comprehensive chapters each focusing on core aspects of microbiology Starting with a historical introduction and the classification of microorganisms readers are gradually introduced to microbial physiology growth nutrition and genetic mechanisms Special attention is given to contemporary topics such as antibiotic resistance genetic engineering bioremediation food microbiology and bioinformatics Written in student friendly language this book blends theoretical knowledge Illustrations real world with practical examples and relevance simplified summaries are included to support easier learning and retention Additionally key terms and review points help reinforce understanding and support exam preparation What sets this book apart is its application driven approach From microbial involvement in agriculture and waste management to their use in biotechnology and diagnostics students will gain insight into the significance of microbes in solving real world problems Whether used in classrooms laboratories or independent study Fundamentals of Microbiology Concepts and Applications serves as a reliable and comprehensive resource It lays a strong foundation for advanced study and research in microbiology while nurturing the scientific curiosity needed for innovation in biological sciences

Recent Advances in Nanotechnology Changhong Ke, 2011-12-15 This title includes a number of Open Access chapters Considered the next industrial revolution nanotechnology is an exciting field with new advances being reported regularly It is a very diverse and highly interdisciplinary field involving the science and engineering fields Nanotechnology deals with the smallest building blocks of matter and inv

Physics and Chemistry Basis of Biotechnology M. de Cuyper, Jeff W.M. Bulte, 2006-04-11 At the end of the 20th century a tremendous progress was made in biotechnology in its widest sense This progress was largely possible as a result of joint efforts of top academic researchers in both pure fundamental sciences and applied research The surplus value of such interdisciplinary approaches was clearly highlighted during the 9th European Congress on Biotechnology that was held in Brussels Belgium 11 15 July 1999 The present volume in the Focus on Biotechnology series entitled Physics and Chemistry Basis for Biotechnology contains selected presentations from this meeting A collection of

experts has made serious efforts to present some of the latest developments in various scientific fields and to unveil prospective evolutions on the threshold of the new millenium In all contributions the emphasis is on emerging new areas of research in which physicochemical principles form the foundation In reading the different chapters it appears that more than ever significant advances in biotechnology very often depend on breakthroughs in the biotechnology itself e g

Fundamentals of Nanotechnology Gabor L. Hornyak, John J. Moore, H.F. Tibbals, Joydeep Dutta, 2018-12-14 WINNER 2009 CHOICE AWARD OUTSTANDING ACADEMIC TITLE Nanotechnology is no longer a subdiscipline of chemistry engineering or any other field It represents the convergence of many fields and therefore demands a new paradigm for teaching This textbook is for the next generation of nanotechnologists It surveys the field s broad landscape exploring the physical basics such as nanorheology nanofluidics and nanomechanics as well as industrial concerns such as manufacturing reliability and safety The authors then explore the vast range of nanomaterials and systematically outline devices and applications in various industrial sectors This color text is an ideal companion to Introduction to Nanoscience by the same group of esteemed authors Both titles are also available as the single volume Introduction to Nanoscience and Nanotechnology Qualifying instructors who purchase either of these volumes or the combined set are given online access to a wealth of instructional materials These include detailed lecture notes review summaries slides exercises and more The authors provide enough material for both one and two semester courses

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