and Bioremediation Economics of Bioresources Integrated and Hybrid Process Technology for Water and Wastewater Treatment Sustainable Resource Management Extraction Strategies to Recover Bioactive Compounds, Incorporation into Food and Health Benefits Microalgae Handbook of Biofuels Economía Circular: fundamentos y aplicaciones

Production of Top 12 Biochemicals Selected by USDOE from Renewable Resources

Algal and sustainable technologies: Bioenergy, Nanotechnology and Green chemistry is an interdisciplinary overview of the world's major problems; water scarcity, clean environment and energy and their sustenance remedy measures using microalgae. It comprehensively presents the way to tackle the socio-economic issues including food, feed, fuel, medicine and health and also entails the untapped potential of microalgae in environmental management, bioenergy solution and sustainable synthesis of pharmaceutical and nutraceutical products. This book basically emphasizes the success of algae as wonderful feed stocks of future and provides upto date information and sustainable and recreational outlook towards degrading environment and energy crisis. Applicability of fast emerging algae based nanotechnology in bioremediation and production of nanoparticle (AuNP, AgNP etc) are beautifully described along with latest research and findings. Key features: The "waste to best to income" strategies are the main concern of the book and take the edge off the problem of pollution, energy and income. Elucidate the sustainable phycoremediation and nanoparticle functions as low cost approach for various ecosystem services. Information regarding pharmaceuticals, nutraceuticals and other algae based value added product synthesis and fate are comprehensively discussed. Knowledge resource, latest research,
findings and prospects presented in an accessible manner for researchers, students, eminent scientists, entrepreneurs, professionals and policy maker.

**Polygeneration Systems**

The importance of biofuels in greening the transport sector in the future is unquestionable, given the limited available fossil energy resources, the environmental issues associated to the utilization of fossil fuels, and the increasing attention to security of supply. This comprehensive reference presents the latest technology in all aspects of biofuels production, processing, properties, raw materials, and related economic and environmental aspects. Presenting the application of methods and technology with minimum math and theory, it compiles a wide range of topics not usually covered in one single book. It discusses development of new catalysts, reactors, controllers, simulators, online analyzers, and waste minimization as well as design and operational aspects of processing units and financial and economic aspects. The book rounds out by describing properties, specifications, and quality of various biofuel products and new advances and trends towards future technology.

**Principles and Applications of Fermentation Technology**

This book focuses on the different kinds of biofuels and biofuel resources. Biofuels represent a major type of renewable energy. As part of a larger bio-economy, they are closely linked to agriculture, forestry and manufacturing. Biofuels have the potential to improve regional energy access, reduce dependence on fossil fuels and contribute to climate protection. Further, this alternative form of energy could revitalize the forestry and agricultural sector and promote the increased use of renewable resources as raw materials.
in a range of industrial processes. Efforts are continuously being made to develop economically competitive biofuels, and microbes play important roles in the production of biofuels from various bioresources. This book elaborates on recent advances in existing microbial technologies and on sustainable approaches to improving biofuel production processes. Additionally, it examines trends in, and the limitations of, existing processes and technologies. The book offers a comprehensive overview of microbial bioresources, microbial technologies, advances in bioconversion and biorefineries, as well as microbial and metabolic engineering for efficient biofuel production. Readers will also learn about the environmental impacts and the influence of climate change on the sustainability of biofuel production. This book is intended for researchers and students whose work involves biorefinery technologies, microbiology, biotechnology, agriculture, environmental biology and related fields.

An Integration of Phycoremediation Processes in Wastewater Treatment

This book aims to inform readers about the recent developments in bioenergy and biofuels covering current issues from an interdisciplinary approach. It will also feature coverage of anticipated future trends related to each particular biofuel. Chapters will consist of original research presented by world class experts in their respective fields. A number of interdisciplinary areas will be incorporated such as Energy & Fuels, Biotechnology, Genomics, Economics, Optimization, Chemical Engineering, Mechanical Engineering and Algae Science. Examples will relate to a matrix of biofuel and energy types such as bioethanol, biobutanol, and biomethane.

Integrated Microbial Fuel Cells for Wastewater Treatment
Elucidates basic scientific principles and technological advances of current practical technologies for resource recovery from waste generated.

**Integrated Sustainable Urban Water, Energy, and Solids Management**

Environmental sustainability is one of the biggest issues faced by the mankind. Rapid & rampant industrialization has put great pressure on the natural resources. To make our planet a sustainable ecosystem, habitable for future generations & provide equal opportunity for all the living creatures we not only need to make corrections but also remediate the polluted natural resources. The low-input biotechnological techniques involving microbes and plants can provide the solution for resurrecting the ecosystems. Bioremediation and biodegradation can be used to improve the conditions of polluted soil and water bodies. Green energy involving biofuels have to replace the fossil fuels to combat pollution & global warming. Biological alternatives (bioinoculants) have to replace harmful chemicals for maintaining sustainability of agro-ecosystems. The book will cover the latest developments in environmental biotech so as to use in clearing and maintaining the ecosystems for sustainable future.

**Solar Power**

An Integration of Phycoremediation Processes in Wastewater Treatment reviews the potential of microalgae to treat wastewater containing highly recalcitrant compounds whose degradation is not achieved by the conventional existing treatments. In addition, the book describes how the microalgae collected after wastewater treatment can be used for obtaining added-value products, hence closing the loop
and contributing to a circular economy. Finally, the technoeconomical aspects of this green technology are addressed, along with the design and development of photobioreactors, genetic aspects, metagenomics and metabolomics. Deals with emerging aspects of algal research, with a special reference to phycoremediation. Covers diversity, mutations, genomics, metagenomics, eco-physiology, culturing, microalgae for food and feed, biofuel production, harvesting of microalgae, separation and purification of biochemicals. Describes the techno-economical assessment, microalgal biotechnology and algal-bacterial systems for wastewater treatment. Presents complex issues associated with cutting-edge biotechnological tools and techniques like next-generation sequencing methods, metabolomics and bioreactor design and development.

**Environmental Biotechnology: For Sustainable Future**

With the high interest in renewable resources, the field of algal biotechnology has undergone a huge leap in importance in recent years. The book *Microalgae Biotechnology - Integration and Economy* treats integrated approaches to bring the high potential of microalgae into application, accelerate the development of really working production processes and put finally the products on the market. Close interaction of biology and process engineering becomes visible in the described processes. The big impact of microalgal biotechnology on our future society is outlined as a desirable consequence of scientific progress. This book will allow protagonists in academia and industry as well as decision makers in industry and politics to get a clear picture of current possibilities and future trends in microalgal biotechnology.
This book critically discusses different aspects of algal production systems and several of the drawbacks related to microalgal biomass production, namely, low biomass yield, and energy-consuming harvesting, dewatering, drying and extraction processes. These provide a background to the state-of-the-art technologies for algal cultivation, CO2 sequestration, and large-scale application of these systems. In order to tap the commercial potential of algae, a biorefinery concept has been proposed that could help to extract maximum benefits from algal biomass. This refinery concept promotes the harvesting of multiple products from the feedstock so as to make the process economically attractive. For the last few decades, algal biomass has been explored for use in various products such as fuel, agricultural crops, pigments and pharmaceuticals, as well as in bioremediation. To meet the huge demand, there has been a focus on large-scale production of algal biomass in closed or open photobioreactors. Different nutritional conditions for algal growth have been explored, such as photoautotrophic, heterotrophic, mixotrophic and oleaginous. This book is aimed at a wide audience, including undergraduates, postgraduates, academics, energy researchers, scientists in industry, energy specialists, policy makers and others who wish to understand algal biorefineries and also keep abreast of the latest developments.

Handbook of Research on Waste Diversion and Minimization Technologies for the Industrial Sector

Production of Top 12 Biochemicals Selected by USDOE from Renewable Resources: Status and Innovation covers all important technological aspects of the production of biochemicals from renewable feedstock. All the important technological aspects of biomass conversion
for example biomass pretreatment, enzymatic hydrolysis for cellulosic sugars production followed by the fermentation into chemicals and downstream recovery of the products is reviewed. Recent technological advancements in suitable microorganism development, bioprocess engineering for biomass conversion for cellulosic sugars production and various fermentation strategies and downstream recovery of these top 12 products is presented. Each bio-chemical selected by US Department of Energy i.e. ethanol, xylitol/sorbitol, furans (5-HMF, 2,5-FDCA,), glycerol & its derivatives, hydrocarbons) isoprene, iso-butadienes and others), lactic acid, succinic acid, 3-hydroxy propionic acid, levulinic acid and biohydrogen/biogas is included in a single book chapter. In addition to the technical aspects of these 12 biochemicals, general technological challenges dealing with lignocellulose refining, perspectives and solutions are elaborated in the book. Also, life cycle analysis, techno-economic viability, and sustainability index of biofuels/biochemicals are comprehensively reviewed in the book. covers uniquely designed scientific and technical literature on USDOE top listed biochemicals production with clear images and tables in the context of biomass valorisation. Includes the clear and simplistic illustration of technological updates on biomass processing, system biology, microbial fermentation, catalysis, regeneration and monitoring of renewable energy and chemicals production Presents fast and reliable source of information on techno-economic analysis, life cycle analysis, technological scouting at industrial scale.Entails fundamental aspects, recent developments in production of renewable chemicals as building block materials for commodity chemicals production.
converting waste to biofuels and value-added products. Biovalorisation has several advantages over conventional bioremediation processes as it helps reduce the costs of bioprocesses. Examples are provided of several successfully commercialized technologies, giving insight into developing potential processes for biovalorisation of different wastes. Different bioprocess strategies are discussed for valorising the wastes coming from the leather industry, olive oil industry, pulp and paper, winery, textile, and food industries, as well as aquaculture. A section on biorefinery for hydrocarbons and emerging contaminants is included to cover concepts on biodesulfurization of petroleum wastes, leaching of heavy metals from E-waste, and bioelectrochemical processes for CO2. Chapters on algal biorefinery are also included to focus on the technologies for conversion of CO2 sequestration and wastewater utilization. Biovalorisation of Wastes to Renewable Chemicals and Biofuels can be used as course material for graduate students in chemical engineering, chemistry, and biotechnology, and as a reference for industrial professionals and researchers who want to gain a basic understanding on the subject. Covers a wide range of topics, from the conversion of wastes to organic acids, biofuels, biopolymers and industrially relevant products Bridges the gap between academics and industry Written in a lucid and self-explanatory style Includes activities/quiz/critical questions

**Algal Biorefinery: An Integrated Approach**

This book represents a novel attempt to describe microbial fuel cells (MFCs) as a renewable energy source derived from organic wastes. Bioelectricity is usually produced through MFCs in oxygen-deficient environments, where a series of microorganisms convert the complex wastes into electrons via liquefaction through a cascade of enzymes in a bioelectrochemical process. The book provides a detailed description of
MFC technologies and their applications, along with the theories underlying the electron transfer mechanisms, the biochemistry and the microbiology involved, and the material characteristics of the anode, cathode and separator. It is intended for a broad audience, mainly undergraduates, postgraduates, energy researchers, scientists working in industry and at research organizations, energy specialists, policymakers, and anyone else interested in the latest developments concerning MFCs.

**Algae and Sustainable Technologies**

Este libro nace con la intención de ser un referente en el nuevo paradigma de la Economía Circular, entendida esta como una nueva forma de hacer, usar, diseñar productos teniendo en cuenta la BIOCAPACIDAD del planeta tierra. Una economía restaurativa y regenerativa por intención y diseño. La economía circular tiene en consideración que los recursos son finitos y que además, para su producción se deben de tener en cuenta un flujo de circularidad que minimice los residuos generados y los desperdicios. Además, cualquier recurso, al final de su vida útil, tendrá una aplicación en otro proceso, convirtiéndose en un nutriente tecnológico que imita el ciclo de los nutrientes biológicos. La Economía Circular, tiene sus raíces en diferentes escuelas de pensamiento del campo de la sostenibilidad, patrimonio natural que se han desarrollado a lo largo de muchos años de teorías de desarrollo económico e industrial, la Ecología Industrial / parques eco-industriales/ la producción más limpia, el diseño regenerativo, la biomímesis que se basa en la observación y análisis de los procesos propios de la naturaleza para crear productos, el diseño de la cuna a la cuna. Podemos por tanto concluir que la Economía Circular es un nuevo paradigma que ha aglutinado distintas aportaciones de diversos campos de conocimiento, incluyendo entre ellos la sostenibilidad.
Tackling the issue of water and wastewater treatment nowadays requires novel approaches to ensure that sustainable development can be achieved. Water and wastewater treatment should not be seen only as an end-of-pipe solution but instead the approach should be more holistic and lead to a more sustainable process. This requires the integration of various methods/processes to obtain the most optimized design. Integrated and Hybrid Process Technology for Water and Wastewater Treatment discusses the state-of-the-art development in integrated and hybrid treatment processes and their applications to the treatment of a vast variety of water and wastewater sources. The approaches taken in this book are categorized as (i) resources recovery and consumption, (ii) optimal performance, (iii) physical and environmental footprints, (iv) zero liquid discharge concept and are (v) regulation-driven. Through these categories, readers will see how such an approach could benefit the water and wastewater industry. Each chapter discusses challenges and prospects of an integrated treatment process in achieving sustainable development. This book serves as a platform to provide ideas and to bridge the gap between laboratory-scale research and practical industry application. Includes comprehensive coverage on integrated and hybrid technology for water and wastewater treatment Takes a new approach in looking at how water and wastewater treatment contributes to sustainable development Provides future direction of research in sustainable water and wastewater treatment

Integrated Approaches Towards Solid Waste Management

Over 80% of globally produced wastewater receives little or no treatment before it is disposed into the
environment. Therefore, it is urgent to develop new wastewater treatment technologies that are sustainable in the broad sense of the word, i.e. not only produce high quality effluents, but also minimise energy expenses, recover energy and nutrients, and apply technology that is appropriate in relation to the availability of skilled personnel. This book compiles the main outcomes of recent efforts to improve the design of waste stabilisation ponds, and confirms the superior performance of high rate algal ponds as a result of process intensification. A anaerobic digestion devoted to biogas production continues to be the preferred strategy for the energy valorisation of the algal biomass, co-digestion with multiple high C/N ratio substrates gathering significant attention over the past years. The potential of algal biomass as a biosorbent for heavy metal removal (Cu, Ni, F) maintains its share in the research field of water bioremediation, while research on nutrient removal has focused on providing new insights on the mechanism of nitrogen and phosphorus removal from wastewater in algal–bacterial systems. Finally, it is worth noticing that breakthroughs in complementary fields of research such as nanotechnology or lighting technology are gradually being implemented in algal biotechnology, with new products such as nanoparticles for water disinfection or photobioreactors illuminated by low intensity LED panels. In Focus – a book series that showcases the latest accomplishments in water research. Each book focuses on a specialist area with papers from top experts in the field. It aims to be a vehicle for in-depth understanding and inspire further conversations in the sector.

Bioelectrochemical Systems

A guide for urban areas to achieve sustainability by recovering water, energy, and solids Integrated Sustainable Urban Water, Energy, and Solids Management presents an integrated and sustainable system of urban
water, used (waste) water, and waste solids management that would save and protect water quality, recover energy and other resources from used water and waste solids including plastics, and minimize or eliminate the need for landfills. The author—a noted expert on the topic—explains how to accomplish sustainability with drainage infrastructures connected to receiving waters that protect or mimic nature and are resilient to natural and anthropogenic stresses, including extreme events. The book shows how to reduce emissions of greenhouse gasses to net zero level through water conservation, recycling, and generating blue and green energy from waste by emerging emission free technologies while simultaneously installing solar power on houses and wind power in communities. Water conservation and stormwater capture can provide good water quality for diverse applications from natural and reclaimed water to blue and green energy and other resources for use by present and future generations. This important book: Considers municipal solid waste as an ongoing source of energy and resources that will eliminate the need for landfills and can be processed along with used water Presents an integrated approach to urban sustainability Offers an approach for reducing greenhouse gas emissions by communities to net zero Witten for students, urban planners, managers, and waste management professionals, Integrated Sustainable Urban Water, Energy, and Solids Management is a must-have guide for achieving sustainable integrated water, energy, and resource recovery in urban areas.
that demonstrate how rapidly the commercial production of microalgae-based food, health and high value products is advancing. It also addresses a range of open questions and challenges in this field. The book highlights the latest advances of interest to those already working in the field, while providing a comprehensive overview for those readers just beginning to learn about the promise of microalgae as a sustainable source of both specialty and commercial products. It offers a valuable asset for commercial algae producers, algae product developers, scientific researchers and students who are dedicated to the advancement of microalgae biotechnology for applications in health, diet, nutrition, cosmetics, biomaterials etc.

Integrated Biorefineries

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.

Bioenergy and Biofuels

Current wastewater treatment technologies are not sustainable simply due to their high operational costs and process inefficiency. Integrated Microbial Fuel Cells for Wastewater Treatment is intended for professionals who are searching for an innovative method to improve the efficiencies of wastewater treatment processes by exploiting the potential of Microbial Fuel Cells (MFCs) technology. The book is broadly divided into four sections. It begins with an overview of the "state of the art" bioelectrochemical systems (BESs) as well as the fundamentals of MFC technology and its potential to enhance wastewater treatment efficiencies and reduce electricity generation cost. In section two, discusses the integration, installation, and optimization of MFC into conventional wastewater treatment processes such as activated sludge process, lagoons, constructed wetlands, and membrane bioreactors. Section three outlines integrations of MFCs into other wastewater processes. The final section provides explorative studies of MFC integrated systems for large scale wastewater treatment and the challenges which are inherent in the upscaling process. Clearly describes the latest techniques for integrating MFC into traditional wastewater treatment processes such as activated sludge process, lagoons, constructed wetlands, and membrane bioreactors Discusses the fundamentals of bioelectrochemical systems for
degrading the contaminants from the municipal and industrial wastewater Covers methods for the optimization of integrated systems

**Biovalorisation of Wastes to Renewable Chemicals and Biofuels**

This fundamental book provides a cross-sectoral, multi-disciplinary view on the biobased economy. It explains opportunities for the value-adding production and use of bioresources, while also discussing the main drivers and obstacles involved. The book is divided into three major parts, the first of which introduces readers to the basics of bioresource economics and engineering. In terms of economics, it discusses decision-making from the policy, producer, investor, and citizen perspectives; in terms of engineering, it addresses key technologies and the processing of bioresources, as well as the development of biorefineries for high-value products on large and small scales. In turn, the book’s second part presents cases focused on different types of energy use, and written by practitioners. The cases illustrate the businesses and technologies involved, as well as the roles of citizens, social organisations and policies. The book’s third and last part highlights opportunities in sustainable agriculture, valuable industrial products and innovative services, while also outlining key conditions for success. Written by a team of scholars and practitioners from various engineering, natural-science and social-science disciplines, the book is primarily intended for undergraduate and graduate students, and for practitioners in business and policy who wish to explore the sustainable production and use of bioresources. All theoretical issues are explained with the aid of real-world examples, making the content highly accessible.

**Urban Mining for Waste Management and Management and**
Resource Recovery

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
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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.

**Biofuels Production – Sustainability and Advances in Microbial Bioresources**

This book introduces the 3R concept applied to wastewater treatment and resource recovery under a double perspective. Firstly, it deals with innovative technologies leading to: Reducing energy requirements, space and impacts; Reusing water and sludge of sufficient quality; and Recovering resources such as energy, nutrients, metals and chemicals, including biopolymers. Besides targeting effective C,N&P removal, other issues such as organic micropollutants, gases and odours emissions are considered. Most of the technologies analysed have been tested at pilot- or at full-scale. Tools and methods for their Economic, Environmental, Legal and Social impact assessment are described. The 3R concept is also applied to Innovative Processes design, considering different levels of innovation: Retrofitting, where novel units are included in more conventional processes; Re-Thinking, which implies a substantial flowsheet modification; and Re-Imagining, with completely new conceptions. Tools are presented for Modelling, Optimising and Selecting the most suitable plant layout for each particular scenario from a holistic technical, economic and environmental point of view.

**Clean Energy and Resources Recovery**

Environmental Materials and Waste: Resource Recovery and Pollution Prevention contains the latest information on environmental sustainability as a wide variety of natural resources are increasingly being exploited to meet the demands of a worldwide growing population and economy. These raw materials cannot, or
can only partially, be substituted by renewable resources within the next few decades. As such, the efficient recovery and processing of mineral and energy resources, as well as recycling such resources, is now of significant importance. The book takes a multidisciplinary approach to fully realize the number of by-products which can be remanufactured, providing the foundation needed across disciplines to tackle this issue. As awareness and opportunities to recover valuable resources from process and bleed streams is gaining interest, sustainable recovery of environmental materials, including wastewater, offers tremendous opportunity to combine profitable and sustainable production. Presents a state-of-the-art guide to environmental sustainability Provides an overview of the field highlighting recent and emerging issues in environmental resource recovery that cover a wide array of by-products for remanufacture potential Details a multidisciplinary approach to fully realize the number of by-products which can be remanufactured, providing the foundation needed across disciplines to tackle these global issues

**Microbial Electrochemical Technologies**

Scientific management strategies can help in exploring anthropogenic wastes (human-made materials) as potential resources through the urban mining concept and be a panacea for sustainable development. This book covers five broader aspects of waste management and resource recovery in urban mining including solid and liquid waste management and treatment. It explains sustainable approaches of urban mining for the effective management of solid and liquid wastes and facilitates their conversion into secondary resources. Overall, this book provides details of urban mining and its different applications including current waste management problems, practices, and challenges faced worldwide. Presents a holistic approach for urban mining considering various types of wastes Describes
contemporary integrated approaches for waste management with specific case studies Provides technical, social, and environmental aspects of solid and liquid wastes Considers aspects of sustainability and a circular bio-economy Incorporates pertinent case studies on water and wastewater management This volume caters to researchers and graduate students in environmental engineering, solid waste management, wastewater treatment, and materials science.

**Environmental Materials and Waste**

Integrated Biorefineries: Design, Analysis, and Optimization examines how to create a competitive edge in biorefinery innovation through integration into existing processes and infrastructure. Leading experts from around the world working in design, synthesis, and optimization of integrated biorefineries present the various aspects of this complex process, capturing the state of the art in the advancing bioeconomy. The book defines an integrated biorefinery as a processing facility that transforms biomass into value-added products—from biofuels and biochemicals to food and pharmaceuticals. The chapters cover biorefinery product and process design, supply chains, process analysis, feedstocks, technologies, and policy and environmental analysis. They focus on second-generation feedstocks, including forestry resources, energy crops, agricultural residues, oils, and various waste materials. With the growing interest in sustainability in general and in renewable resources in industrial facilities, biorefineries are likely to play increasingly significant roles and have greater economic, environmental, and societal impact. This book fills an information gap by presenting cutting-edge advances that can effectively guide engineers and decision makers in the synthesis, selection, design, analysis, and optimization of biorefineries.

**Microalgal Biotechnology: Integration and**
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**Economy**

Microalgae: Cultivation, Recovery of Compounds and Applications supports the scientific community, professionals and enterprises that aspire to develop industrial and commercialized applications of microalgae cultivation. Topics covered include conventional and emerging cultivation and harvesting techniques of microalgae, design, transport phenomena models of microalgae growth in photobioreactors, and the catalytic conversion of microalgae. A significant focus of the book illustrates how marine algae can increase sustainability in industries like food, agriculture, biofuel and bioprocessing, among others. This book is a complete reference for food scientists, technologists and engineers working in the bioresource technology field. It will be of particular interest to academics and professionals working in the food industry, food processing, chemical engineering and biotechnology. Explores emerging technologies for the clean recovery of antioxidants from microalgae Includes edible oil and biofuels production, functional food, cosmetics and animal feed applications Discusses microalgae use in sustainable agriculture and wastewater treatment Considers the techno-economic aspects of microalgae processing for biofuel, chemicals, pharmaceuticals and bioplastics

**Biofuels Production and Processing Technology**

Microalgae can be future resource for industrial biotechnology In current energy crisis era, microalgae are under tremendous research focus for the production of biodiesel due to their high photosynthetic efficiency, growth rate and high lipid content compared to territorial plants. However, the large-scale production of algal biomass and downstream processing of harvested algae towards bio-fuels are facing several challenges from economic viability perspective. A part from bio-fuels, the microalgae
synthesize number of bio-molecules such as pigments (e.g., chlorophyll, carotenoid), protein (e.g., lectin, phycobiliprotein), and carbohydrates (e.g., agar, carrageenan, alginate, fucodian) which are available in the various forms of microalgal products. Therefore, developing a strategy for large-scale production and use of algal biomass for the co-production of these value-added macromolecules is thus imperative for the improvement of the economics of algal biorefinery. In the above context, this book covers three major areas (i) commercial-scale production of bio-molecules from microalgae, (ii) sustainable approach for industrial-scale operation, and (iii) optimization of downstream processes. Each of these sections is composed of several chapters written by the renowned academicians/industry experts. Furthermore, in this book, a significant weightage is given to the industry experts (around 50%) to enrich the industrial perspectives. We hope that amalgamate of fundamental knowledge from academicians and applied research information from industry experts will be useful for forthcoming implementation of a sustainable integrated microalgal biorefinery. This book highlights following. Explores biomolecules from microalgae and their applications Discusses microalgae cultivations and harvesting Examines downstream processing of biomolecules Explores sustainable integrated approaches for industrial scale operations Examines purification techniques specific for microalgal proteins, Omega 3 fatty Acids, carbohydrates, and pigments

**Sustainable Downstream Processing of Microalgae for Industrial Application**

The protection of clean water, air, and land for the habitation of humans and other organisms has become a pressing concern amid the intensification of industrial activities and the rapidly growing world population. The integration of environmental science...
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with engineering principles has been introduced as a means of long-term sustainable development. The Handbook of Research on Advancements in Environmental Engineering creates awareness of the role engineering plays in protecting and improving the natural environment. Providing the latest empirical research findings, this book is an essential reference source for executives, educators, and other experts who seek to improve their project's environmental costs.

Microalgae Biotechnology for Food, Health and High Value Products

Handbook of Biofuels looks at the many new developments in various type of bioenergy, along with the significant constraints in their production and/or applications. Beyond introducing current approaches and possible future directions of research, this title covers sources and processing of raw materials to downstream processing, constraints involved and research approaches to address and overcome these needs. Different combinations of products from the biorefinery are included, along with the material to answer questions surrounding the optimum process conditions for conversion of different feedstocks to bioenergy, the basis for choosing conversion technology, and what bioenergy products make economic sense. With chapters on the techno-economic analysis of biofuel production and concepts and step-by-step approaches in bioenergy processing, the objective of this book is to present a comprehensive and all-encompassing reference about bioenergy to students, teachers, researchers and professionals. Reviews all existing and emerging technologies surrounding the production of advanced biofuels, including biodiesel and bioethanol. Includes biofuel applications with compatible global application case studies. Offers new pathways for converting biomass.

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

This book is the second in a two-volume set devoted to bioelectrochemical systems (BESs) and the opportunities that they may offer in providing a green solution to growing energy demands worldwide. While the first volume explains principles and processes, in this volume established research professionals shed light on how this technology can be used to generate high-value chemicals and energy using organic wastes. Bioelectricity is generated in microbial fuel cells (MFCs) under oxygen-depleted conditions, where microbial bioconversion reactions transform organic wastes into electrons. Dedicated chapters focus on MFCs and state of the art advancements as well as current limitations. In addition, the book covers the use of microbial biofilm- and algae-based bioelectrochemical systems for bioremediation and co-generation of valuable chemicals. A thorough review of the performance of this technology and its possible industrial applications is presented. The book is designed for a broad audience, including undergraduates, postgraduates, energy researchers/scientists, policymakers, and anyone else interested in the latest developments in this field.

Proceedings of the National Conference on Utilization of Bioresources

Due to various issues in the world including rapid urbanization and industrial processes, waste generation has reached levels that are becoming detrimental to the environment and the global population. Waste management has remained a challenging issue for many professional sectors as it is directly linked to an organization’s performance; however, the implementation of efficient and cost-effective waste minimization plans is the first step in improving the global environment. Innovative
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technologies in waste management are emerging and can help professionals looking to implement more efficient methods of pollution control. The Handbook of Research on Waste Diversion and Minimization Technologies for the Industrial Sector is a pivotal reference source that provides vital research on the application of modern pollution-control methodologies in industrialized environments. While highlighting topics such as life cycle assessment, bioremediation, and thermal waste treatment, this publication explores environmental risk reduction scenarios as well as sustainable waste-collecting solutions. This book is ideally designed for researchers, industrialists, environmentalists, practitioners, policymakers, scientists, students, and academicians seeking current research on innovative advancements in waste minimization techniques.

**Handbook of Microalgae-Based Processes and Products**

The Handbook of Microalgae-based Processes and Products provides a complete overview of all aspects involved in the production and utilization of microalgae resources at commercial scale. Divided into four parts (fundamentals, microalgae-based processes, microalgae-based products, and engineering approaches applied to microalgal processes and products), the book explores the microbiology and metabolic aspects of microalgae, microalgal production systems, wastewater treatment based in microalgae, CO2 capture using microalgae, microalgae harvesting techniques, and extraction and purification of biomolecules from microalgae. It covers the largest number of microalgal products of commercial relevance, including biogas, biodiesel, bioethanol, biohydrogen, single-cell protein, single-cell oil, biofertilizers, pigments, polyunsaturated fatty acids, bioactive proteins, peptides and amino acids, bioactive polysaccharides, sterols, bioplastics, UV-screening compounds, and
volatile organic compounds. Moreover, it presents and discusses the available engineering tools applied to microalgae biotechnology, such as process integration, process intensification, and techno-economic analysis applied to microalgal processes and products, microalgal biorefineries, life cycle assessment, and exergy analysis of microalgae-based processes and products. The coverage of a broad range of potential microalgae processes and products in a single volume makes this handbook an indispensable reference for engineering researchers in academia and industry in the fields of bioenergy, sustainable development, and high-value compounds from biomass, as well as graduate students exploring those areas. Engineering professionals in bio-based industries will also find valuable information here when planning or implementing the use of microalgal technologies. Covers theoretical background information and results of recent research. Discusses all commercially relevant microalgae-based processes and products. Explores the main emerging engineering tools applied to microalgae processes, including techno-economic analysis, process integration, process intensification, life cycle assessment, and exergy analyses.

Microbial Biodegradation and Bioremediation

Economics of Bioresources

A wide variety of detail regarding genuine and proprietary research from distinguished authors is presented, ranging from new means of evaluation of the local solar irradiance to the manufacturing technology of photovoltaic cells. Also included is the topic of biotechnology based on solar energy and electricity generation onboard space vehicles in an optimised manner with possible transfer to the Earth. The graphical material supports the presentation,
transforming the reading into a pleasant and instructive labor for any interested specialist or student.

**Integrated and Hybrid Process Technology for Water and Wastewater Treatment**

Clean Energy and Resources Recovery: Biomass Waste Based Biorefineries, Volume One presents the technological options for energy and resources recovery from all types of organic wastes. The book addresses municipal and industrial sludges, municipal solid waste, agro-residue, animal wastes, industrial waste, forestry residue, and algal biomass, and provides a global overview of biomass waste production, waste handling issues and related GHG emissions and climate change, legislative waste management guidelines, biomass composition, and conventional methods for biomass waste treatment. For each biomass waste, chapters cover energy and bio-based products recovery, pre-treatment methods, process microbiology, community dynamics, co-digestion, reactor design and configuration, and techno-economic evaluation. Case studies on upscaling technology and pilot and industry scale implementation are included, alongside step-by-step calculations that integrate practical field data and regulatory requirements into the environmental design process. Finally, future trends and developments in advanced biotechnological concepts for biomass waste processing and management are also discussed. Provides innovative strategies to increase the efficiency of anaerobic digestion, including during pre- and post-treatment. Includes industry case studies that demonstrate successful implementation processes and strategies. Addresses municipal and industrial sludges, municipal solid waste, agro-residue, animal wastes, industrial waste, forestry residue, and algal biomass, and provides a global overview of biomass waste production.
Sustainable Resource Management

We are pleased to present this book, which is a reprint of articles from the Special Issue entitled “Extraction Strategies to Recover Bioactive Compounds, Incorporation into Food, and Health Benefits” published online in the open access journal Foods (ISSN 2304-8158) from 2019 to 2020 (available at: https://www.mdpi.com/journal/foods/special_issues/extraction). Firstly, this book gathers studies addressing several strategies applied to obtain bioactive products and extracts, not only from food matrices but also from agri-food byproducts, which can serve as new natural additives, nutraceuticals, and functional ingredients for pharmaceutical, cosmetics, and food industries. In particular, free and bound phenolic compounds are explored in buckwheat, sesame, and olive leafy byproducts. Overall, these studies outline new valorization methods and offer new opportunities for alternative practices in the agro-industrial sector that help to migrate toward a circular bioeconomy model. This book also presents studies that predict bioactive components in fruits through mathematical tools and support the formulation of a novel beverage rich in resveratrol, a phenolic compound whose bioactivity is well recognized.

Extraction Strategies to Recover Bioactive Compounds, Incorporation into Food and Health Benefits

The need for exploration, conservation, and sustainable utilization of bioresources is undeniable for the survival and growth of mankind. This new book throws light on new and recent research on and development of effective strategies for sustainable utilization of bioresources using modern tools and techniques to help meet this challenge. This volume addresses the utilization of bioresources in therapeutics, in biofuel, in agriculture, and in
environmental protection. Beginning with the diverse potential applications of bioresources in food, medicine, and cosmetics, the volume goes on to address the various different underutilized bioresources and their sustainable uses. It discusses important advances in biofuel and patents that highlight recent developments that address the energy crises and the continuously fluctuating cost of petroleum. It explores new renewable energy sources from bioresources and their sustainable utilization in the bioenergy and biofuel industry. Several chapters focus on the sustainable utilization of bioresources in the agricultural sector. The volume considers that developing countries have huge agricultural resources that could be employed for production of value-added byproducts for the sustainable development of a bio-based economy. The book discusses efficient use of underexploited natural bioresources, new chemical approaches for the generation of novel biochemicals, and the applications of genetics approaches for bioresource conservation and production of value-added products. Further, strategies for the production of biopesticides utilizing bioresources are also discussed.

**Microalgae**

The book covers all aspects of fermentation technology such as principles, reaction kinetics, scaling up of processes, and applications. The 20 chapters written by subject matter experts are divided into two parts: Principles and Applications. In the first part subjects covered include: Modelling and kinetics of fermentation technology Sterilization techniques used in fermentation processes Design and types of bioreactors used in fermentation technology Recent advances and future prospect of fermentation technology The second part subjects covered include: Lactic acid and ethanol production using fermentation technology Various industrial value-added product
biosynthesis using fermentation technology Microbial cyp450 production and its industrial application Polyunsaturated fatty acid production through solid state fermentation Application of oleaginous yeast for lignocellulosic biomass based single cell oil production Utilization of micro-algal biomass for bioethanol production Poly-lactide production from lactic acid through fermentation technology Bacterial cellulose and its potential impact on industrial applications

Handbook of Biofuels

In the developing countries, pollution through solid waste, sludge from water and wastewater treatment plants and pollution of natural water resources have become one of the grave issues. The root cause is population explosion, industrialization, urbanization and other anthropogenic activities. The increase rate of solid waste has become a major challenge for sustainable development of the environment. Poor management of solid waste and sludge from water and wastewater treatment plants may be the cause of health hazards and environmental problems. The book presents new methods and technologies to combat the aforementioned problems and focuses on the importance of using the recycled products. The technologies related to waste and sludge treatment are economical, eco-friendly and bring economic returns, and can be applied to most of the developing countries where waste treatment technologies, viz. composting, anaerobic digestion, recycling of plastic and agricultural waste in construction can be used. The aim of the book is to support everyone who is involved in academics, teaching, research related to solid waste management and water and wastewater treatment study in the leading academic and research organizations globally. This book will be of prodigious value to upcoming researchers, scholars, scientists and professionals in Environmental Science.
and Engineering fields, and global and local authorities and policy makers responsible for the management of solid wastes and sludge. Globally, universities can develop new prospectuses on sustainable and eco-friendly waste and sludge management, which are relating to the book's theme. This book can also be of great source for designing and operation of waste reuse and recycling programmes.

**Economía Circular: fundamentos y aplicaciones**

The support for polygeneration lies in the possibility of integrating different technologies into a single energy system, to maximize the utilization of both fossil and renewable fuels. A system that delivers multiple forms of energy to users, maximizing the overall efficiency makes polygeneration an emerging and viable option for energy consuming industries. Polygeneration Systems: Design, Processes and Technologies provides simple and advanced calculation techniques to evaluate energy, environmental and economic performance of polygeneration systems under analysis. With specific design guidelines for each type of polygeneration system and experimental performance data, referred both to single components and overall systems, this title covers all aspects of polygeneration from design to operation, optimization and practical implementation. Giving different aspects of both fossil and non-fossil fuel based polygeneration and the wider area of polygeneration processes, this book helps readers learn general principles to specific system design and development through analysis of case studies, examples, simulation characteristics and thermodynamic and economic data. Detailed economic data for technology to assist developing feasibility studies regarding the possible application of polygeneration technologies Offers a comprehensive list of all current numerical and experimental results of polygeneration available Includes simulation models, cost figures,
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demonstration projects and test standards for designers and researchers to validate their own models and/or to test the reliability of their results

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