

Vincenza Faraco *Editor*

# Lignocellulose Conversion

Enzymatic and Microbial Tools for  
Bioethanol Production

 Springer

# Lignocellulose Conversion Enzymatic And Microbial Tools For Bioethanol Production

**Sonil Nanda,Prakash Kumar  
Sarangi,Dai-Viet N. Vo**



## **Lignocellulose Conversion Enzymatic And Microbial Tools For Bioethanol Production:**

**Lignocellulose Conversion** Vincenza Faraco,2013-06-12 Bioethanol has been recognized as a potential alternative to petroleum derived transportation fuels Even if cellulosic biomass is less expensive than corn and sugarcane the higher costs for its conversion make the near term price of cellulosic ethanol higher than that of corn ethanol and even more than that of sugarcane ethanol Conventional process for bioethanol production from lignocellulose includes a chemical physical pre treatment of lignocellulose for lignin removal mostly based on auto hydrolysis and acid hydrolysis followed by saccharification of the free accessible cellulose portions of the biomass The highest yields of fermentable sugars from cellulose portion are achieved by means of enzymatic hydrolysis currently carried out using a mix of cellulases from the fungus *Trichoderma reesei* Reduction of hemi cellulases production costs is strongly required to increase competitiveness of second generation bioethanol production The final step is the fermentation of sugars obtained from saccharification typically performed by the yeast *Saccharomyces cerevisiae* The current process is optimized for 6 carbon sugars fermentation since most of yeasts cannot ferment 5 carbon sugars Thus research is aimed at exploring new engineered yeasts abilities to co ferment 5 and 6 carbon sugars Among the main routes to advance cellulosic ethanol consolidate bio processing namely direct conversion of biomass into ethanol by a genetically modified microbes holds tremendous potential to reduce ethanol production costs Finally the use of all the components of lignocellulose to produce a large spectra of biobased products is another challenge for further improving competitiveness of second generation bioethanol production developing a biorefinery

Microbial Enzymes: Roles and Applications in Industries Naveen Kumar Arora,Jitendra Mishra,Vaibhav Mishra,2020-04-28 Microbial Enzymes Roles and applications in industry offers an essential update on the field of microbial biotechnology and presents the latest information on a range of microbial enzymes such as fructosyltransferase laccases amylases lipase and cholesterol oxidase as well as their potential applications in various industries Production and optimisation technologies for several industrially relevant microbial enzymes are also addressed In recent years genetic engineering has opened up new possibilities for redesigning microbial enzymes that are useful in multiple industries an aspect that the book explores In addition it demonstrates how some of the emerging issues in the fields of agriculture environment and human health can be resolved with the aid of green technologies based on microbial enzymes The topics covered here will not only provide a better understanding of the commercial applications of microbial enzymes but also outline futuristic approaches to use microbial enzymes as driver of industrial sustainability Lastly the book is intended to provide readers with an overview of recent applications of microbial enzymes in various industrial sectors and to pique researchers interest in the development of novel microbial enzyme technologies to meet the changing needs of industry

**New and Future Developments in Microbial Biotechnology and Bioengineering** Neha Srivastava,Manish Srivastava,P.K. Mishra,Pramod W. Ramteke,Ram Lakhan Singh,2019-05-03 New and Future Developments in Microbial

Biotechnology and Bioengineering From Cellulose to Cellulase Strategies to Improve Biofuel Production outlines new methods for the industrial production of the cellulose enzyme The book compares the various processes for the production of biofuels including the cost of cellulose production and availability Biofuels are considered to be the main alternatives to fossil fuels in reducing environmental pollution and climate change Currently all existing biofuel production is suffering because of the high costs of production processes As a result cost effective practical implementation is needed to make this a viable energy alternative Introduces new and innovative strategies for cellulase enzyme production at industrial scale Provides sustainable approaches to produce cellulase at low cost Covers all aspect and possible factors for economical low cost cellulase mediated biofuels production

### **Lignocellulosic Materials and Their Use in Bio-based Packaging**

Lina Fernanda Ballesteros, Michele Michelin, António Augusto Vicente, José António Teixeira, Miguel Ângelo Cerqueira, 2018-06-18 This brief provides a comprehensive review of lignocellulosic materials and their primary role in the future development of bio based packaging Topics such as sources and extraction methods of lignocellulosic materials main constituents of lignocellulosic materials functionality of lignocellulosic materials the development of bio based and biodegradable packaging incorporation of lignocellulosic materials in bio based packaging materials properties and functionality of bio based packaging are discussed by authors who are experts in the field

### **Advances in Yeast Biotechnology for Biofuels and Sustainability**

Achlesh Daverey, Kasturi Dutta, Sanket Joshi, Teresa Gea, 2023-05-23 Advances in Yeast Biotechnology for Biofuels and Sustainability Value Added Products and Environmental Remediation Applications showcases the uses for engineered yeast in environmental applications especially as an innovative source of biofuels Beginning with a thorough review of recent advances and future potential for yeast biotechnology the book proceeds to outline several options for biofuels including lignocellulosic biofuels and alternative feedstock production through hydrolysis and alternative value added products including industrial acids and bioplastics and applications in agriculture and environmental remediation Placing case studies at the center of each chapter this book presents a future focused perspective on the potential of yeast biotechnologies to support sustainability Lays out methods including multiple options for generating biofuels from engineered yeast and several additional value added products Presents a wide variety of real world sustainable applications for engineered yeast with a focus on biofuels production Provides a selection of case studies in other value added products and applications including bioremediation pollution remediation and biofertilizers in sustainable agriculture

*Bioethanol Production from Food Crops* Ramesh C. Ray, S Ramachandran, 2018-08-20 Bioethanol Production from Food Crops Sustainable Sources Interventions and Challenges comprehensively covers the global scenario of ethanol production from both food and non food crops and other sources The book guides readers through the balancing of the debate on food vs fuel giving important insights into resource management and the environmental and economic impact of this balance between demands Sections cover Global Bioethanol from Food Crops and Forest Resource Bioethanol from Bagasse and

Lignocellulosic wastes Bioethanol from algae and Economics and Challenges presenting a multidisciplinary approach to this complex topic As biofuels continue to grow as a vital alternative energy source it is imperative that the proper balance is reached between resource protection and human survival This book provides important insights into achieving that balance Presents technological interventions in ethanol production from plant biomass to food crops Addresses food security issues arising from bioethanol production Identifies development bottlenecks and areas where collaborative efforts can help develop more cost effective technology

Improvements in Bio-Based Building Blocks Production Through Process Intensification and Sustainability Concepts Juan Gabriel Segovia-Hernandez, Eduardo Sanchez-Ramirez, César Ramírez-Márquez, Gabriel Contreras-Zarazúa, 2021-09-14 Improvements in Bio Based Building Blocks Production Through Process Intensification and Sustainability Concepts discusses new information on the production and cost of bio based building blocks From a technical point of view almost all industrial materials made from fossil resources can be substituted using bio based counterparts However the cost of bio based production in many cases exceeds the cost of petrochemical production In addition new products must be proven to perform at least as good as their petrochemical equivalents have a lower environmental impact meet consumer demand for environmentally friendly products factor in population growth and account for limited supplies of non renewables This book outlines the application of process intensification techniques which allow for the generation of clean efficient and economical processes for bio based chemical blocks production Includes synthesis and process design strategies for intensified processes Describes multi objective optimization applied to the production of bio based building blocks Presents the controllability of processes where the production of bio based building blocks is involved Provides examples using aspen and MATLAB Introduces several sustainable indexes to evaluate production processes Presents process intensification techniques to improve performance in productive processes

*Genetic and Genome-Wide Microbial Insights: Bioenergy* Javid Ahmad Parray, Niraj Singh, Dilfuza Egamberdieva, 2025-02-24 Genetic and Genome Wide Microbial Insights Bioenergy Microbial Genomics Volume 3 delves into the cutting edge developments in the field of metagenomics encompassing both metatranscriptomics and metaproteomics This comprehensive resource highlights the significant potential of metagenomics in screening previously uncultivated microbial species It underscores the pivotal role of these advanced genomic techniques in accessing elusive microorganisms thereby revolutionizing the production of biofuels This book emphasizes the practicality of these methods aiming to make biofuel production more economically feasible and efficient Genetic and Genome Wide Microbial Insights Bioenergy offers both a foundational overview and the most recent advancements in microbial genomics computational genomics and enzyme engineering It details the process of upscaling and bio prospecting microbial strains specifically tailored for biofuel production providing a comprehensive guide that bridges basic concepts with cutting edge research This book covers a range of topics including advanced microbial fuel production techniques Sustainable bioenergy genomics and biofuel development and microbial engineering The comprehensive chapters

in this book will appeal to readers from diverse backgrounds in biology life sciences agriculture environmental engineering genome engineering and even medicine Explores the integration of metagenomics and enzyme engineering in the upscaling of biofuel production Presents recent omics applications and delves into the biological mechanisms that drive microbial biofuel production Traces the journey from metagenomics to byproducts focusing on the bio prospecting of microbial strains

Paddy Straw Waste for Biorefinery Applications Neha Srivastava,Bhawna Verma,P. K. Mishra,2024-01-08 This book provides an exclusive and critical in depth analysis of paddy straw waste valorization at a broad scale for different industrial applications It explores and discusses the various valorization pathways of paddy straw into valuable products connected to biorefineries products and byproducts The book also examines the scope potential and availability of paddy straw in the field of biorefineries Various lignocellulosic biomasses with expanded potential are known for their industrial applications even at a broad pilot range Among these biomasses paddy straw has emerged as the most suitable lignocellulosic waste for various biorefinery applications Paddy is a crucial and widely consumed crop globally and it generates the highest annual production of waste compared to other cereal crops The cellulose content accounting for approximately 47% of the total cellulosic biomass offers significant potential for valorization along with hemicellulose and lignin which can also be explored and expanded on an industrial scale However despite the tremendous scope for valorization lignocellulosic biomass based biorefineries face cost effectiveness challenges that need to be addressed for sustainable and uniform expansion distribution and economic scalability in various applications The book s specific feature lies in its targeted and specific valorization of paddy straw into biofuels and other biorefinery based products which hold promising industrial applications and easily scalable approaches for mass production This book is an essential resource for students scientists engineers and practitioners working in the biorefinery industry and academia

**Advances in Feedstock Conversion Technologies for Alternative Fuels and Bioproducts** Majid Hosseini,2019-02-23 **Advances in Feedstock Conversion Technologies for Alternative Fuels and Bioproducts** New Technologies Challenges and Opportunities highlights the novel applications of and new methodologies for the advancement of biological biochemical thermochemical and chemical conversion systems that are required for biofuels production The book addresses the environmental impact of value added bio products and agricultural modernization along with the risk assessment of industrial scaling The book also stresses the urgency in finding creative efficient and sustainable solutions for environmentally conscious biofuels while underlining pertinent technical environmental economic regulatory and social issues Users will find a basis for technology assessments current research capability progress and advances as well as the challenges associated with biofuels at an industrial scale with insights towards forthcoming developments in the industry Presents a thorough overview of new discoveries in biofuels research and the inherent challenges associated with scale up Highlights the novel applications and advancements for biological biochemical thermochemical and chemical conversion systems that are required for biofuels production Evaluates risk

management concerns addressing the environmental impact of value added bio products and agricultural modernization and the risk assessment of industrial scaling      **Fuel Processing and Energy Utilization** Sonil Nanda,Prakash Kumar Sarangi,Dai-Viet N. Vo,2019-02-22 This book provides different aspects on fuel processing and refinery for energy generation Most updated research findings along with case studies real scenario examples and extensive analyses of original research work and literature reviews is included in this book      **Advances in Aerogel Composites for Environmental**

**Remediation** Aftab Aslam Parwaz Khan,Mohammad Omaish Ansari,Anish Khan,Abdullah M. Asiri,2021-05-29 Advances in Aerogel Composites for Environmental Remediation presents both contextual information aboutaerogels and details about their application in environmental remediation A wide variety of aerogels are discussed rangingfrom common to advanced and from natural to synthetic By exploring ongoing research and developments in the environmentalremediation technologies using aerogel and its composites this book addresses common day to day environmental problemsand presents solutions to the use of aerogel materials The chapters discuss fabrication of various aerogel composites alongwith their design and applications toward different environmental remediation technologies Additionally the properties andadvantages of aerogels are compared and contrasted to those of traditional materials Given the consistent increase in environmental pollution there is an urgent need to explore new materials for advances in remediationtechnology Advances in Aerogel Composites for Environmental Remediation brings researchers and practitionersin the fields of environmental remediation environmental science and engineering to the forefront of remediation technologieswith a thorough breakdown of the benefits of and techniques relevant to aerogel composites Covers basic properties unique properties and fabrication techniques of aerogels from basic silica aerogels topresent day conventional aerogels Discusses most of the major environmental remediation techniques and the advantages of using aerogels for theseremediation techniques in comparison to using traditional methods Presents future prospects for utilizing aerogels in modern day to day life and in the fabrication of tangible new products

**Bioprosects of Macrofungi** Sunil Kumar Deshmukh,Kandikere Ramaiah Sridhar,Hesham Ali El Enshasy,2023-10-13 The discipline of mycology is a fascinating one It has a major influence on the nutrition health and environmental safety of mankind Cultivation of edible and non edible mushrooms for nutrition pharmaceuticals biopolymers and biocomposites will open up new avenues in research as well as the more profitable utilization of agricultural residues Cultivation and of domesticated and wild mushrooms poses a challenge to fulfill the needs of human animal nutrition and utilization of agrowastes tangibly Cultivation of ectomycorrhizal fungi benefits nutrition as well as plant protection Macrofungi are the major source of several metabolites of nutritional health agricultural and industrial significance e g antioxidants antimicrobials and pigments Macrofungal bio composites provide alternatives to the use of animal derived or plant derived products e g nanopapers leather and packaging materials They serve a dual role in providing nutrition and pharmaceuticals nutraceuticals to humans as well as livestock Macrofungi interact with insects symbiotically e g Termitomyces with termites

and provide delicious nutraceutical product They also control insects by infecting and producing pharmaceutically and metabolite rich products e g Cordyceps attacks insects Macrofungi have a strong potential to control pathogens like nematodes in soil bioremediation They are also useful as biofertilizers to meet the needs of plant nutrition The book outlines current advances in macrofungal technology It highlights different facets of macrofungal cultivation bioactive compounds biocomposites nutraceuticals benefits with interaction with insects application as biofertilizers and ecosystem services like bioremediation

**Plant Biotechnology: Progress in Genomic Era** S. M. Paul Khurana,Rajarshi Kumar Gaur,2019-11-14 Refinement in sequencing technologies and potential of genomic research resulted in meteoric growth of biological information such as sequences of DNA RNA and protein requiring databases for efficient storage management and retrieval of the biological information Also computational algorithms for analysis of these colossal data became a vital aspect of biological sciences The work aims to show the process of turning bioscience innovation into companies and products covering the basic science the translation of science into technology Due to rapid developments there seems to be no basic difference between the pharmaceutical industry and the biotechnological industry However approved products in the pipeline and renewed public confidence make it one of the most promising areas of economic growth in the near future India offers a huge market for the products as well as cheap manufacturing base for export The book is a sincere work of compilation of new and recent advances in the topic of concern through various innovative researches and scientific opinion therefrom The book is dedicated to the readers who will definitely find it interesting and knowledgeable in carrying out their respective researches in different aspects of applied microbiology and biotechnology

*Biodiversity and Bioeconomy* Kripal Singh,Milton Cezar Ribeiro,Ozgul Calicioglu,2023-09-30 Biodiversity and Bioeconomy Status Quo Challenges and Opportunities comprehensively delivers the latest developments in theories of biodiversity and ecosystem functioning and their major implications for biodiversity conservation through diversifying agriculture forestry and biomass production systems and linking these developments with sustainability of bioeconomy This book provides basic understanding of biodiversity and bioeconomy different views of their interrelationship and their links with sustainable development goals It also examines the research and practice of biodiversity and ecosystem functioning in agriculture forestry and biomass production systems to achieve sustainable bioeconomy Finally this book examines status challenges and opportunities for biodiversity centered bioeconomy providing a way forward Examines the status of scientific understanding of biodiversity and bioeconomy and interrelatedness Describes challenges and opportunities for socioeconomic and ecologically sustainable development of bioeconomy Covers agriculture forestry and aquatic ecosystems and explores their biodiversity and bioeconomy potentials

**Mycodegradation of Lignocelluloses** R. Narayan,2019-10-16 This book provides a knowledge based view to the dynamic capabilities in an organization The author integrates two existing views on gaining competitive advantage the Knowledge View which suggests that the capability of organizations to learn faster than competitors is the only source of



competitiveness and the Dynamic Capability View which speculates that a firm's competitive advantage rests on its ability to adapt to changes in the business environment Using the IT sector in India as a case study this book provides and tests a new framework Knowledge Based Dynamic Capabilities in the prediction of competitive advantage in organizations

Handbook of Climate Change Mitigation and Adaptation Maximilian Lackner, Baharak Sajjadi, Wei-Yin Chen, 2025-09-26  
Now in its 4th extended edition this completely revised and significantly expanded handbook addresses important new research findings and the global need for action related to climate change in its two most relevant aspects mitigation and adaptation There is a growing consensus that anthropogenic activities have been driving global climate change and the consequence will be catastrophic for civilization Reducing the 37.1 billion metric tons of CO<sub>2</sub> produced annually 2017 global emissions along with other greenhouse gases particularly methane has become a leading grand challenge and the pursuit of sustainable energy environments and economies is a complex issue affecting the daily life of every citizen In this 4th edition readers will find new chapters covering the causes and impacts of global warming the climate change impacts on health biodiversity and the economy and emerging technologies for climate change mitigation Particular attention is given to topics such as wildfire threats ocean acidification coral bleaching sea level rise and permafrost thaw The latest research on sustainable aviation fuels carbon mineralization and smart cities is also covered in this new edition as well as topics like sustainable building design climate resistant building materials and sustainable agriculture The Handbook of Climate Change Mitigation and Adaptation collates information in this multi disciplinary area providing readers with a comprehensive overview of the scientific background and current and emerging technologies Intended for an interdisciplinary global audience of researchers and decision makers at universities and in industry it covers climate change models established mature and promising future technologies and ideas the impact of climate change strategies for dealing with global warming the related political frameworks and climate education

*Biotechnological Advances in Biorefinery* Komal Agrawal, Pradeep Verma, 2024-10-03 This book is unique as it will cover the latest technological advancements in the field of biorefinery and how it is a major futuristic component of global biofuel research Initially the role of bio based waste materials microorganisms and their bioactive metabolites in biorefinery will be focused Further recent advances and emerging topics that are related to industrially important products such as biofuels hydrogen production will also be elaborated The book addresses the lack of understanding of recent technological advancement such as life cycle assessment LCA and techno economic assessment TEA as well The systems for biorefineries demand a methodical approach to identifying effects and evaluating their long term viability Thus a futuristic paradigm focusing on in silico studies will also be incorporated enabling us to understand the developments and impacts of bio based materials towards a circular and sustainable economy Additionally the proposed book will also discuss various strategies such as the analysis of cost effectiveness nanotechnology value sensitive design VSD and also emphasize the economic technical and environmental aspects that affect their production

as well as the future perspective in terms of the market scenario Thus the book will provide cumulative information on various dimensions of biorefinery and its role as a major bio economic industry of the future for researchers industrialists entrepreneurs career starters and policymakers The shift towards a bioeconomy not only promises innovative solutions to pressing global challenges but also opens up new avenues for various industries and policymakers Thus biorefinery is regarded as a crucial aspect of biobased economy ultimately leading the path towards sustainability Industrial Biotechnology Devarajan Thangadurai,Jeyabalan Sangeetha,2017-03-03 This important new book covers recent advancements innovations and technologies in industrial biotechnology specifically addressing the application of various biomolecules in industrial production and in cleaning and environmental remediation sectors The goal of industrial biotechnology is to develop new techniques and technologies to transform renewable raw materials into chemicals materials and fuels by the substitution of fossil fuels With the increase in the world s population and the resultant growing energy demand the need for more energy can be successfully met with the advancements in industrial biotechnology Currently across the globe significant research has been undertaken in the production of cleaner fuels materials and semi synthetic chemicals with environmental benefits Developing countries have huge agricultural resources that could be utilized for production of value added byproducts for the sustainable development of bio based economy The book opens with the chapter on the production of exopolysaccharides from halophilic microorganisms a polymer that is normally very useful in various production sectors of the food pharmaceutical and petroleum industries The book goes on to cover The production of antimicrobial compounds from alkaliphilic bacteria Thermophilic actinomycetes Food agro and pharmaceutical potential and biotechnological applications of biosurfactants halophiles cyclodextrin glycosyl transferease fungal chitinase proteases yeasts and yeast products Also covered in the book are the environmental aspects of industrial biotechnology such as the genetic enhancement for biofuel production the production of biodegradable thermoplastics advancements in the synthesis of bio oil ecofriendly treatment of agro based lignocelluloses and anaerobic bio reactors for hydrocarbon remediation The international roster of chapter authors have been chosen for their renowned expertise and contribution to the various fields of industrial biotechnology This book is suitable to chemists biotechnologists from research institutes academia and students as well as for industry professionals Biofuels: Greenhouse Gas Mitigation and Global Warming Ashwani Kumar,Shinjiro Ogita,Yuan-Yeu Yau,2018-02-09 This timely book is a compilation of edited articles by distinguished international scientists discussing global warming its causes as well as present and future solutions Social and economic growth at global level is measured in terms of GDP which requires energy inputs generally based on fossil fuel resources These however are major contributors to increasing levels of CO<sub>2</sub> causing 15 tonnes of green house gas emissions per capita Renewable sources of energy offer an alternative to fossil fuels and would help reduce this to the 2 tonnes of greenhouse gas emissions per capita per annum needed to achieve sustainable growth As such the book discusses the next generation of biofuels and all related

aspects based on the editors significant investigations on biofuels over the last 30 years It also presents the latest research findings from research work carried out by contemporary researchers Presenting global biofuel perspectives it examines various issues related to sustainable development of biofuels in the contexts of agriculture forestry industry and economic growth It covers the 1st to 4th generation biofuels as well as the status of biofuel resources and their potential in carbon neutral economy Offering a comprehensive state of art overview of current and future biofuels at local and global levels this book appeals to administrators policy makers universities and research institutions

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