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Recent Progress in Bioconversion of Lignocellulosics

Recent Progreb In Bioconversion Of Lignocellulosics

Ponnusami V.,Kiran Babu Uppuluri,Rangabhashiyam S,Pardeep Singh

Recent Progreb In Bioconversion Of Lignocellulosics:

Recent Progress in Bioconversion of Lignocellulosics G.T. Tsao,2003-06-30 This volume describes recent advances in the bioconversion of lignocellulosics It starts with two articles on genetics and properties of cellulases and their re tion kinetics and mechanisms The cost of cellulases has been a hindrance to large scale use of enzymatic hydrolysis Two articles on cellulase production by submerged fermentation and by solid state fementation are included to describe the state of the art in this area Dilute acid hydrolysis of cellulose continues to be of interest as well as potentially useful The most recent advances in this area is also covered A great deal of progress has been made in genetic engineering for improved regulation of xylose fermentation by yeasts An article on genetically engineered Saccharomyces for simulteaneous fermentation of glucose and xylose describes the importance advances made in production of fuel ethanol from lignocellulosic biomass In recent years there has been increasing interests in recycling and the reuse of scrap paper as well as environment considerations A contribution is presented which describes the research perspectives in that area Finally recent advances in the use of lignocellulosic biomass for the p duction of ethanol and organic acids are presented in two articles Renewable resources are inevitably of great importance in the years to come There is a never ending search for better living conditions for human beings The more resource materials can be recycled the richer we will be **Recent Progress in Bioconversion of Lignocellulosics** G. T. Tsao,2014-01-15 *Lignocellulose Bioconversion Through White Biotechnology* Anuj Kumar Chandel,2022-09-13 Lignocellulose Bioconversion Through White Biotechnology Comprehensive resource summarizing the recent technological advancements in white biotechnology and biomass conversion into fuels chemicals food and more Lignocellulose Bioconversion Through White Biotechnology presents cutting edge information on lignocellulose biomass conversion detailing how white biotechnology can develop sustainable biomass pretreatment methods effective plant cell wall degrading enzymes to yield high quality cellulosic sugars and the eventual conversion of these sugars into fuels chemicals and other materials To provide comprehensive coverage of the subject the work offers in depth critical analysis into both techno economic and life cycle analysis of lignocellulose based products Each of the 16 chapters written by a well qualified and established researchers academics or engineers presents key information on a specific facet of lignocellulose based products Topics covered include Lignocellulose feedstock availability types of feedstock and potential crops that are of high interest to the industry Lignocellulose bioconversion including both foundational technical aspects and new modern developments Plant cell wall degrading enzymes including cellulase improvement and production challenges solutions when scaling up Improvements and challenges when considering fermenting microorganisms for cellulosic sugars utilization Scaling up of lignocellulose conversion including insight into current challenges and future practices Techno economic aspects of lignocellulose feedstock conversion green consumerism and industrialization aspects of renewable fuels chemicals Students academics researchers bio business analysts and policy makers working on sustainable fuels chemicals materials

and renewable fuels can use Lignocellulose Bioconversion Through White Biotechnology to gain invaluable expert insight into the subject its current state of the art and potential exciting future avenues to explore *Recent Advances in Bioconversion of Lignocellulose to Biofuels and Value Added Chemicals within the Biorefinery Concept* Edivaldo Ximenes Ferreira Filho,Leonora Rios de Souza Moreira,Eduardo de Aquino Ximenes,Cristiane Sanchez Farinas,2020-05-07 Recent Advances in Bioconversion of Lignocellulose to Biofuels and Value Added Chemicals within the Biorefinery Concept covers the latest developments on biorefineries along with their potential use for the transformation of residues into a broad range of more valuable products Within this context the book discusses the enzymatic conversion process of lignocellulosic biomass to generate fuels and other products in a unified approach It focuses on new approaches to increase enzymatic production by microorganisms the action of microbial inhibitors and strategies for their removal Furthermore it outlines the benefits of this integrated approach for generating value added products and the benefits to social and economic aspects circular bio economy HUBs and perspectives Covers the mechanisms of enzymatic conversion of biomass into value added products Discusses bioproducts derived from lignocellulose and their applications Includes discussions on design development and the technologies needed for the sustainable manufacture of materials and chemicals Offers a techno economic evaluation of biorefineries for integrated sustainability assessments Discusses the socioeconomic and cultural economic perspectives of the lignocellulosic biorefinery Presents a virtual biorefinery as an integrated approach to evaluate the lignocellulose production chain Renewable Biofuels Vandana Rana,Diwakar Rana,2016-12-08 This book offers a complete introduction for novices to understand key concepts of biocatalysis and how to produce in house enzymes that can be used for low cost biofuels production The authors discuss the challenges involved in the commercialization of the biofuel industry given the expense of commercial enzymes used for lignocellulose conversion They describe the limitations in the process such as complexity of lignocellulose structure different microbial communities actions and interactions for degrading the recalcitrant structure of lignocellulosic materials hydrolysis mechanism and potential for bio refinery Readers will gain understanding of the key concepts of microbial catalysis of lignocellulosic biomass process complexities and selection of microbes for catalysis or genetic engineering to improve the production of bioethanol or biofuel **Bioconversion of Lignocellulosic Biomass to Microbial Lipids** Zening Wang,2018 **Bioconversion of Lignocellulosic Materials to Ethanol** ,1989*

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

Bioconversion of Lignocellulosic Material Warwick Lloyd Marsden,1983 *Lignocellulose Biotechnology* Ramesh Chander Kuhad,Ajay Singh,2007 The agricultural and forestry processing wastes lignocellulosics are an important material resource and energy source However if untreated they can pose a danger to the environment and potentially valuable resources Microorganisms contribute significantly to solving the problem of biomass degradation its recycling and conservation In the recent years an increasing interest shown by the textile food feed pulp and paper industries in the microbial and enzymatic processes has triggered in depth studies of lignocellulolytic microorganisms and their enzymes Moreover the advent of recombinant DNA technology in the late 1970s further paved the way for developing technologies based on lignocellulolytic microbes and enzymes Lignocellulose Biotechnology presents a comprehensive review of the research directed towards environmentally friendly agricultural and forest by products The book comprises 22 chapters divided in four sections It deals with a wide range of topics including biodiversity of lignocellulose degrading microorganisms and their enzymes molecular biology of biodegradation of lignin characterization of lignocellulolytic enzymes bioconversion of plant biomass to produce enzymes animal feed bioethanol and industrial applications of lignocellulolytic enzymes The chapters dealing with industrial applications also address current biotechnological approaches in lignocellulose bioconversion to value added products This book is essential for students researchers scientists and engineers working in the fields of environmental microbiology environmental biotechnology life sciences waste management and biomaterials

Lignocellulosic Biomass Refining for Second Generation Biofuel Production Ponnusami V.,Kiran Babu Uppuluri,Rangabhashiyam S,Pardeep Singh,2023-07-14 This book compiles research aspects of second generation 2G biofuel production derived specifically from lignocellulose biomass using biorefinery methods It focuses on the valorization of different sources of 2G biofuels and their relative importance The constituents of lignocelluloses and their potential characteristics different methods of treating lignocellulose various means of lignocellulose bioconversion and biofuel production strategies are discussed Features Describes technological advancements for bioethanol production from

lignocellulosic waste Provides the roadmap for the production and utilization of 2G biofuels Introduces the strategic role of metabolic engineering in the development of 2G biofuels Discusses technological advancements life cycle assessment and prospects Explores the novel potential lignocellulosic biomass for 2G biofuels This book is aimed at researchers and professionals in renewable energy biofuel bioethanol lignocellulose conversion fermentation and chemical engineering

Bioconversion of Lignocellulosic By-products to L(+)-lactic Acid by Lactobacillus Cultures Shengde Zhou,1997

Bioconversion of Heterogeneous Lignocellulosic Biomass for Sugar Production Rodrigo Morales Vera,2015 In order to accomplish large scale utilization of lignocellulosic feedstocks to produce fuels and chemicals a consistent inexpensive and stable supply of biomass from a variety of sources will be required These biomass will be heterogeneous and will change as a function of time and price and will most likely be available to the biorefinery in a mixed input stream with diverse physico chemical properties Consequently a potential biomass processing facility must be able to convert these diverse feedstock without significantly altering the overall performance sugar yields and fuel production Currently most bioconversion research has been carried out with high quality raw material such as clean wood chips and agricultural residues and little attention has been paid to the efficiency of converting diverse feedstocks into fermentable sugars and fuels Since particle size reduction is expensive and energy intensive but a critical operation for preparing the biomass for pretreatment initial particle size heterogeneity was studied during the bioconversion of hybrid poplar Different particles sizes ranging from 0 2x0 2 cm to 2 0x1 5 cm plus an equal mixture of all the particles were used to determine the influence of initial particle size heterogeneity during sugar production of hybrid poplar HP via bioconversion It was found that there is essentially no effect of particle size heterogeneity on saccharification after steam pretreatment The overall sugar recovery from all the samples ranged from 87 90% and 61 64% for glucose and xylose respectively and was not influenced by particle size Alongside showing that bioconversion of HP managed different particles size and considering the availability of wheat straw WS as potential feedstock for a biorefinery The influence of mixing these two feedstock during the bioconversion for sugar production were investigated Despite that raw HP and WS have different physico chemical properties mixing both types of biomass positively affects the bioconversion process In fact mixed biomass exhibited on average 20% more sugar production than either single biomass Since it was showed that is technically feasible the utilization of different combinations HP and WS as a feedstock for sugar production a techno economics analysis was performed to determine and compare the economic feasibility of processing simultaneously mixed biomass HP and WS vs using single HP and WS in a campaign processing plan for ethanol production The ethanol yields from process simulations estimated that mixed biomass yield 10 more gallons of ethanol per ton of biomass than using single HP and WS in a campaign system Mixed biomass generate almost twice as much income per year than using single biomass in campaign plan processing which is equivalent to extra 13 5 million per year Techno economic analysis indicated that production of ethanol using mixed biomass is more competitive vs

using single HP and WS in campaign design processing to ethanol production **Computer Conference on Bioconversion of Lignocellulosics for Fuel, Fodder and Food** International Development Research Centre (Canada),1983 Bioconversion of Lignocellulosic Materials to Fuels and Chemicals ACS. Biotechnology Secretariat,ACS. Cellulose, Paper and Textile Division, **Microbial Utilization and Bioconversion of Lignocellulosic Hydrolysates** Yan Wang,2021 *Bioconversion of Lignocellulosic Substrate Into Lactic Acid-pretreatment and Extractive Fermentation* Rongfu Chen,1997 **Use of Process Design and Metabolic Engineering to Enhance Bioconversion of Lignocellulosic Biomass and Glycerol to Biofuels** Chidozie Victor Agu,2016 Recent efforts to reduce dependency on food based substrates for industrial applications aim towards the use of inexpensive and readily available non food based substrates such as lignocellulosic biomass LB and biodiesel derived glycerol Interestingly the utilization of lignocellulosic sugars for biofuel production is contingent on the disruption of recalcitrant LB cell wall structure prior to enzyme hydrolysis Disruption and hydrolysis processes generate lignocellulose derived microbial inhibitory compounds LDMIC including acids aldehydes and phenolics Additionally fermentation of glycerol to butanol a next generation biofuel is hampered by the inability of Clostridium beijerinckii NCIMB 8052 a butanol fermentation workhorse to efficiently metabolize glycerol Therefore this study investigated novel strategies for enhancing butanol and ethanol production through process design and metabolic engineering Towards process design the bacterium Cupriavidus basilensis ATCC BAA 699 was used to detoxify 98% of the LDMIC present in acid pretreated Miscanthus giganteus MG lignocellulosic biomass hydrolysates Fermentation of the detoxified MG hydrolysates by C beijerinckii resulted in 70% 50% and 73% improvement in acetone butanol ethanol ABE concentration yield and productivity respectively when compared to the fermentation of undetoxified MG hydrolysates The second objective was to explore metabolic engineering strategies to enhance glycerol utilization by C beijerinckii and improve butanol production in the presence of LDMIC To realize this objective genes that encode glycerol dehydrogenases Gldh and dihydroxyacetone kinase Dhak in a hyper glycerol utilizing bacterium Clostridium pasteurianum ATCC 6013 were systematically cloned into C beijerinckii By over expressing two C pasteurianum Gldh genes dhaD1 gldA1 as a fusion protein in C beijerinckii we achieved 50% increase in cell growth ABE production up to 40% and enhanced rate of furfural detoxification up to 68% during the fermentation of furfural challenged 4 to 6 g L glucose glycerol medium Further co expression of dhaD1 gldA1 resulted in significant payoff in cell growth 57% glycerol consumption 14% and ABE productivity 27 3% compared to over expression of a single Gldh In parallel while co expression of dhak and gldA1 in C beijerinckii improved glycerol consumption by 37% relative to the plasmid control over expression of all three genes dhaD1 gldA1 dhak improved butanol production by 50% in the presence of 5 and 6 g L furfural relative to the plasmid control Objective 3 aimed to develop a high throughput alcohol dehydrogenase ADH dependent assay for screening hyper or hypo butanol producing C beijerinckii mutant libraries Screening of the activities of ADHs from different microorganisms showed that Thermotoga

hypogea derived ADH has 7 fold activity towards butanol than ethanol It was rationalized that T hypogea ADH can be used to selectively quantify butanol in the presence ofethanol e g in ABE broth Objective 4 aimed to use allopurinol to inhibit xanthine dehydrogenase oxidase and improve ethanol fermentation of LB hydrolysates by Saccharomyces cerevisiae Allopurinol increased S cerevisiae growth 19% ethanol titer 21% ethanol productivity 20% ethanol yield 24% and the chronological lifespan of S cerevisiae 16 h during the fermentation of 100% corn stover hydrolysate Taken together this study encompasses novel strategies to enhance LB and glycerol utilization and potentially improve the economics of biobutanol and bioethanol production *Optimizing Chemical-free Pretreatments for the Bioconversion of Lignocellulosic Biomass from Douglas-Fir (Pseudotsuga Menziesii Var. Menziesii) Forest Wood Residuals* Bon-Jae Gu,2018 Lignocellulosic biomass is an abundant and sustainable resource to produce biofuel as an alternative energy resource for fossil fuels The biomass is mainly composed of cellulose hemicellulose and lignin Monosaccharides can be produced from cellulose and hemicellulose through enzymatic hydrolysis and subsequent fermentation of the mono sugars to fuels To effectively obtain the sugar content from the biomass suitable pretreatments are required since enzymatic hydrolysis is negatively impacted by the sturdy structure of the biomass The external layers of the biomass act as barriers of the internal cellulose against enzymes attachment reducing sugar yield through hydrolysis Thermo mechanical pretreatment is an effective method to enhance enzymatic hydrolysis by opening the recalcitrant structures and thus increasing sugar yield from the biomass without the generation of inhibitors of hydrolysis and fermentation Pulverization is useful to decrease the particle size of the biomass and increase the specific surface area where enzymes can attach to degrade the polymers to monomer sugars Extrusion process improves the cellulose accessibility to enzymes by disrupting the complex rigid structures due to continuous shear stress during the process Direct steam injection process enhances the degradation of hemicellulose and modification of lignin The potential of thermo mechanical pretreatments for increasing sugar yield was explored in this research A multi step milling process was developed to optimize energy requirement Extrusion process variables were studied to improve enzymatic hydrolysis Direct steam injection process was evaluated for its ability to increase solubility of hemicellulose and the denaturation of lignin The combination milling strategies showed great potential with better energy efficiency Extrusion process effectively opened the recalcitrant structures increasing the accessibility of enzymes to the substrate Extrusion process with high temperature resulted in recrystallization and re agglomeration To prevent the re agglomeration a new screw configuration was developed The addition of the direct steam injection process in conjunction with the extrusion processing did not result in significant increase in the sugar yields Thus an effort was made to develop physical and thermal pretreatment technologies with higher energy efficiency to increase the production of fermentable sugar from lignocellulosic biomass *Bioconversion of Lignocellulosic Materials Into Fuel Ethanol* Zhangwen Wu,1998

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