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Process Synthesis for Fuel Ethanol Production

Microbial Nanobiotechnology This report demonstrates by computer simulation the economic advantages of extractive fermentation on an industrial scale compared to the best alternative technology currently available. The simulations were based on a plant capacity of 100 x 10^6 L/y of azeotropic ethanol. The simulation results were verified with a fully integrated, computer controlled extractive fermentation process demonstration unit based around a 7 L fermentor operated with a synthetic glucose medium and using Saccharomyces cerevisiae. The system was also operated with natural substrates (blackstrap molasses and grain hydrolyzate). Preliminary tests with the organism Zymomonas mobilis were also carried out under extractive fermentation conditions.

Multiscale Modelling of Biorefineries Due to the increasing demand for new fuels that are
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economically attractive, and as part of the quest for energy alternatives to replace carbon-based fuels, the purification of ethanol plays a key role. Bioethanol is an environmentally-friendly fuel with less greenhouse gases emissions than gasoline, but with similar energy power.

Nevertheless the large-scale production of bioethanol fuel requires energy demanding distillation steps to concentrate the diluted streams from the fermentation step and to overcome the azeotropic behavior of the ethanol-water mixture. This work presents the design and optimization of a dehydration process for ethanol, using two separation sequences: a conventional arrangement using distillation and extractive distillation and an alternative arrangement based on liquid-liquid extraction and extractive distillation. Moreover, different solvents were optimized simultaneously in the liquid-liquid extraction column, while ethylene glycol was used as extractive agent in the extractive distillation (ED). Both sequences were optimized using a stochastic global optimization algorithm of differential evolution (DE) coupled to rigorous Aspen Plus simulations. The economic feasibility of utilities for the two configurations was studied by changing the ethanol/water composition in the analyzed feed stream. The results demonstrate significant savings around 20% in total annual cost when the alternative arrangement is used.

Industrial Chemical Process Analysis and Design Optimization plays a key role in the design, planning and operation of chemical and related processes for several decades. Techniques for solving optimization problems are of
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deterministic or stochastic type. Of these, stochastic techniques can solve any type of optimization problems and can be adapted for multiple objectives. Differential evolution (DE), proposed about two decades ago, is one of the stochastic techniques. Its algorithm is simple to understand and use. DE has found many applications in chemical engineering. This unique compendium focuses on DE, its recent developments and applications in chemical engineering. It will cover both single and multi-objective optimization. The book contains a number of chapters from experienced editors, and also several chapters from active researchers in this area.

19th European Symposium on Computer Aided Process Engineering Presenting a comprehensive analysis of the use of alternative sources of energy and technologies to produce fuels and power, this book describes the energy value chain from harvesting the raw material, (i.e solar, wind, biomass or shale gas) followed by analysis of the processing steps into power, fuels and/or chemicals and finally the distribution of the products. Featuring an examination of the techno-economic processes and integration opportunities which can add value to by-products or promote the use of different sources of energy within the same facility, this book looks at the tools that can make this integration possible as well as utilising a real world case study. The case study of the operation of “El hierro” island is used as an example of the current effort towards more efficient use of the resources available. Tackling head on the open challenges of the supply, the variability of the source and its
prediction, the description of novel processes that are being developed and evaluated for their transformation as well as how we can distribute them to the consumer and how we can integrate the new chemicals, fuels and power within the current system and infrastructure, the book takes a process based perspective with such an approach able to help us in the use and integration of these sources of energy and novel technologies.

Optimization of Acid Hydrolysis in Ethanol Production from Prosopis juliflora Sustainable Biofuels: Opportunities and challenges, a volume in the “Applied Biotechnology Reviews series, explores the state-of-the-art in research and applied technology for the conversion of all types of biofuels. Its chapters span a broad spectrum of knowledge, from fundamentals and technical aspects to optimization, combinations, economics, and environmental aspects. They cover various facets of research, production, and commercialization of bioethanol, biodiesel, biomethane, biohydrogen, biobutanol, and biojet fuel. This book discusses biochemical, thermochemical, and hydrothermal conversion of unconventional feedstocks, including the role of biotechnology applications to achieve efficiency and competitiveness. Through case studies, techno-economic analysis and sustainability assessment, including life cycle assessment, it goes beyond technical aspects to provides actual resources for better decision-making during the development of commercially viable technology by researchers, PhD students, and practitioners in the field of bioenergy. It is also a useful resource for those in adjacent areas, such as biotechnology, industrial microbiology, chemical engineering,
environmental engineering, and sustainability science, who are working on solutions for the bioeconomy. The ability to compare different technologies and their outcome that this book provides is also beneficial for energy analysts, consultants, planners, and policy-makers. The “Applied Biotechnology Reviews series highlights current development and research in biotechnology-related fields, combining in single-volume works the theoretical aspects and real-world applications for better decision-making. Covers current technologies and advancements in biochemical, thermochemical, and hydrothermal conversion methods for production of various types of biofuels from conventional and nonconventional feedstock. Examines biotechnology processes, including genetic engineering of microorganisms and substrates, applied to biofuel production. Bridges the gap between technology development and prospects of commercialization of bioprocesses, including policy and economics of biofuel production, biofuel value chains, and how to accomplish cost-competitive results and sustainable development.

Biofuels Biorefinery of Oil Producing Plants for Value-Added Products. An instructive and up-to-date pretreatment and industrial applications of oil producing plants. Biorefinery of Oil Producing Plants for Value-Added Products is a two-volume set that delivers a comprehensive exploration of oil producing plants, from their availability to their pretreatment, bioenergy generation, chemical generation, bioproduct generation, and economic impact. The distinguished team of editors has included a wide variety of highly instructive resources written by leading experts.
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contributors to the field. This set explores the current and future potential of bioenergy production to address the energy and climate crisis, as well as the technologies used to produce materials like biogas, biodiesel, bioethanol, biobutanol, biochar, fuel pellets, and biohydrogen. It also discusses the production of biobased chemicals, including bio-oil, biosurfactants, catanionic surfactants, glycerol, biovanillin, bioplastic, and plant-oil based polyurethanes. Concluding with an insightful analysis of the economic effects of oil producing plants, the set also offers readers: A thorough introduction to the availability of oil producing plants, including palm oil, castor oil, jatropha, nyamplung, and coconut A comprehensive exploration of the pretreatment of oil producing plants, including the physical, chemical and biological pretreatment of lignocellulosic biomass Practical discussion of the generation of bioenergy, including biogas generation in the palm oil mill and biodiesel production techniques using jatropha. In-depth examinations of the generation of biobased chemicals, including those produced from the tobacco plant Perfect for researchers and industry practitioners involved with the biorefinery of oil producing plants, Biorefinery of Oil Producing Plants for Value-Added Products also belongs in the libraries of undergraduate and graduate students studying agriculture, chemistry, engineering, and microbiology.

Identification and Optimization of Process Parameters for the Production of Bioethanol from the Fermentation of Oil Palm Trunks SAP This will be a comprehensive multi-contributed reference
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work, with the Editors being highly regarded alternative fuels experts from India and Switzerland. There will be a strong orientation toward production of biofuels covering such topics as biodiesel from renewable sources, biofuels from biomass, vegetable based feedstocks from biofuel production, global demand for biofuels and economic aspects of biofuel production. Book covers the latest advances in all product areas relative to biofuels. Discusses coverage of public opinion related to biofuels. Chapters will be authored by world class researchers and practitioners in various aspects of biofuels. Provides good comprehensive coverage of biofuels for algae. Presents extensive discussion of future prospects in biofuels.

11th International Symposium on Process Systems Engineering - PSE2012 Sustainability of Products, Processes and Supply Chains: Theory and Applications presents the recent theoretical developments and applications on the interface between sustainability and process systems engineering. It offers a platform for cutting-edge, holistic analyses of key challenges associated with computer-aided tools for incorporating sustainability principles and approaches into the design and operations of multi-scale process systems, ranging from molecular and products systems, to energy and chemical processes, and supply chains. Presents recent theoretical developments and applications on the interface between sustainability engineering and process engineering Offers cutting-edge, holistic analyses of key challenges associated with computer-aided tools for incorporating sustainability principles and
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approaches into the design and operations of multi-scale process systems. Brings together the perspectives of leading researchers to stimulate innovative thinking in terms of sustainability.

Economic and Process Optimization of Ethanol Production by Extractive Fermentation This book contains the proceedings of the 10th of a series of international symposia on process systems engineering (PSE) initiated in 1982. The special focus of PSE09 is how PSE methods can support sustainable resource systems and emerging technologies in the areas of green engineering. * Contains fully searchable CD of all printed contributions * Focus on sustainable green engineering * 9 Plenary papers, 21 Keynote lectures by leading experts in the field.

Alternative Energy Sources and Technologies Comprehensive Biotechnology, Third Edition unifies, in a single source, a huge amount of information in this growing field. The book covers scientific fundamentals, along with engineering considerations and applications in industry, agriculture, medicine, the environment and socio-economics, including the related government regulatory overviews. This new edition builds on the solid basis provided by previous editions, incorporating all recent advances in the field since the second edition was published in 2011. Offers researchers a one-stop shop for information on the subject of biotechnology. Provides in-depth treatment of relevant topics from recognized authorities, including the contributions of a Nobel laureate. Presents the perspective of researchers in different fields, such as biochemistry, agriculture, engineering,
biomedicine and environmental science

Process Design and Optimization of Bio-ethanol Production System The 19th European Symposium on Computer Aided Process Engineering contains papers presented at the 19th European Symposium of Computer Aided Process Engineering (ESCAPE 19) held in Cracow, Poland, June 14-17, 2009. The ESCAPE series serves as a forum for scientists and engineers from academia and industry to discuss progress achieved in the area of CAPE. * CD-ROM that accompanies the book contains all research papers and contributions * International in scope with guest speeches and keynote talks from leaders in science and industry * Presents papers covering the latest research, key top areas and developments in computer aided process engineering (CAPE)

Comprehensive Biotechnology Process synthesis and process intensification are becoming state-of-the-art scientific fields that provide the methods and tools to improve process technologies in terms of high energy efficiency, low capital investment, low emissions, improved safety, and less hazardous byproducts to achieve sustainable products and processes. The book covers manufacturing processes from both fossil- and biomass-based feedstocks for graduate students.

Sustainable Design Through Process Integration The only textbook that applies thermodynamics to real-world process engineering problems This must-read for advanced students and professionals alike is the first book to demonstrate how chemical thermodynamics work in the real world by applying them to actual engineering examples. It
also discusses the advantages and disadvantages of the particular models and procedures, and explains the most important models that are applied in process industry. All the topics are illustrated with examples that are closely related to practical process simulation problems. At the end of each chapter, additional calculation examples are given to enable readers to extend their comprehension. Chemical Thermodynamics for Process Simulation instructs on the behavior of fluids for pure fluids, describing the main types of equations of state and their abilities. It discusses the various quantities of interest in process simulation, their correlation, and prediction in detail. Chapters look at the important terms for the description of the thermodynamics of mixtures; the most important models and routes for phase equilibrium calculation; models which are applicable to a wide variety of non-electrolyte systems; membrane processes; polymer thermodynamics; enthalpy of reaction; chemical equilibria, and more. -Explains thermodynamic fundamentals used in process simulation with solved examples -Includes new chapters about modern measurement techniques, retrograde condensation, and simultaneous description of chemical equilibrium -Comprises numerous solved examples, which simplify the understanding of the often complex calculation procedures, and discusses advantages and disadvantages of models and procedures -Includes estimation methods for thermophysical properties and phase equilibria thermodynamics of alternative separation processes -Supplemented with MathCAD-sheets and DDBST programs for readers to reproduce the examples Chemical Thermodynamics for Process
Simulation is an ideal resource for those working in the fields of process development, process synthesis, or process optimization, and an excellent book for students in the engineering sciences.

Process Systems Engineering for Biofuels Development This edited book serves as a vital resource on the contributions of microorganisms to advances in nanotechnology, establishing their applications in diverse areas of biomedicine, environment, biocatalysis, food and nutrition, and renewable energy. It documents the impacts of microorganisms in nanotechnology leading to further developments in microbial nanobiotechnology. This book appeals to researchers and scholars of microbiology, biochemistry and nanotechnology.

Membrane Distillation Process Ethanol: Science and Engineering reviews the most significant research findings in both ethanol production and utilization. The book's contents are divided into four parts, beginning with an explanation of the chemical reactions involved during the conversion of ethanol to more complex molecules. Other sections focus on various processes and their potential use, the modelling of various chemical processes, and finally, their economic and environmental impact. The book includes the most advanced production processes, new technologies, applications, and the economic role ethanol plays today. The book will be great for researchers and engineers in both academic and industry. The idea of using ethanol as a fuel is one of the most promising options in the arena of alternative fuels because of its versatile use as an
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intermediate for producing hydrogen via reforming reactions, direct fuel cells feed and/or its production from biomass, which is also considered a sustainable feedstock. Reviews ethanol production methods from biomass Discusses the potential of ethanol as a viable future fuel Includes hydrogen production methods using ethanol in catalytic reforming processes Outlines the various technologies based on ethanol Includes ethanol powered fuel cells

Special Topics in Renewable Energy Systems Alcohol fuels must remain as an essential component for the realization of a sustainable low-carbon society. Use of locally available, under-utilized feedstock becomes important for local energy security as well as an option for distributed energy infrastructure. Utilizing the available feedstock that has not been properly regarded as a legitimate resource due to economic and social reasons should be the focal point in the search for possible resources for alcohol fuels. Lignocellulosic biomass and algal species are feedstocks that suit the purpose. This book can provide a brief introduction regarding the recent advances in the alcohol fuel field that is in constant challenge from recent issues on CO2, shale oil, power-to-gas, and hydrogen.

Sustainable Design for Renewable Processes This book provides an overview of the multi-dimensional approach for the production of ethanol from lignocellulosic biomass. The sustainability of this biofuel, the current and future status of the technology and its role in waste valorization are also addressed. Bioethanol from lignocellulosic material has emerged as an
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alternative to the traditional first-generation bioethanol. The book also discusses various pretreatment methods for effective separation of the various components of lignocellulosic feedstock as well as their advantages, and limitations. It describes the valorization of lignocellulosic waste through the production of bioethanol and emphasizes the significance of waste utilization in managing the production cost of the fuel. Finally, the utilization of genetically engineered plants and microorganisms to increase the conversion efficiency is reviewed.

3rd Kuala Lumpur International Conference on Biomedical Engineering 2006 Process engineering can potentially provide the means to develop economically viable and environmentally friendly technologies for the production of fuel ethanol. Focusing on a key tool of process engineering, Process Synthesis for Fuel Ethanol Production is a comprehensive guide to the design and analysis of the most advanced technologies for fuel

Sustainable Biofuels Industrial Chemical Process Analysis and Design uses chemical engineering principles to explain the transformation of basic raw materials into major chemical products. The book discusses traditional processes to create products like nitric acid, sulphuric acid, ammonia, and methanol, as well as more novel products like bioethanol and biodiesel. Historical perspectives show how current chemical processes have developed over years or even decades to improve their yields, from the discovery of the chemical reaction or physico-chemical principle to the industrial process
needed to yield commercial quantities. Starting with an introduction to process design, optimization, and safety, Martin then provides stand-alone chapters—in a case study fashion—for commercially important chemical production processes. Computational software tools like MATLAB®, Excel, and Chemcad are used throughout to aid process analysis. Integrates principles of chemical engineering, unit operations, and chemical reactor engineering to understand process synthesis and analysis. Combines traditional computation and modern software tools to compare different solutions for the same problem. Includes historical perspectives and traces the improving efficiencies of commercially important chemical production processes. Features worked examples and end-of-chapter problems with solutions to show the application of concepts discussed in the text.

Handbook of Biofuels Sustainable Design for Renewable Processes: Principles and Case Studies covers the basic technologies to collect and process renewable resources and raw materials and transform them into useful products. Starting with basic principles on process analysis, integration and optimization that also addresses challenges, the book then discusses applied principles using a number of examples and case studies that cover biomass, waste, solar, water and wind as resources, along with a set of technologies including gasification, pyrolysis, hydrolysis, digestion, fermentation, solar thermal, solar photovoltaics, electrolysis, energy storage, etc. The book includes examples, exercises and models using Python, Julia, MATLAB®, GAMS, EXCEL, CHEMCAD or ASPEN. This book shows
students the challenges posed by renewable-based processes by presenting fundamentals, case studies and step-by-step analyses of renewable resources. Hence, this is an ideal and comprehensive reference for Masters and PhD students, engineers and designers. Addresses the fundamentals and applications of renewable energy process design for all major resources, including biomass, solar, wind, geothermal, waste and water. Provides detailed case studies, step-by-step instructions, and guidance for each renewable energy technology. Presents models and simulations for a wide variety of platforms, including state-of-the-art and open access platforms in addition to well-known commercial software.

10th International Symposium on Process Systems Engineering - PSE2009 Master's Thesis from the year 2012 in the subject Engineering - Chemical Engineering, Addis Ababa University, language: English, abstract: Lignocellulosic materials (eg. Prosopis juliflora) can be utilized to produce ethanol, a promising alternative energy source for the limited crude oil. This study involved optimisation of acid hydrolysis in ethanol production from prosopis juliflora. The conversion of prosopis juliflora to ethanol can be achieved mainly by three process steps: pretreatment of prosopis juliflora wood to remove lignin and hemicellulose, acid hydrolysis of pretreated prosopis juliflora to convert cellulose into reducing sugar (glucose) and fermentation of the sugars to ethanol using Saccharomyces cerevisiae in anaerobic condition. A two level full factorial design with four factors, two levels and two replicas (2^4=2^2=32 experimental runs) was applied to optimize acid
hydrolysis and study the interaction effects of acid hydrolysis factors, namely, acid concentration, solid fraction, temperature, and time. An optimization was carried out to optimize acid hydrolysis process variables so as to determine the best acid concentration, solid fraction, temperature, and contact time that resulted maximum ethanol yield. The screening of significant acid hydrolysis factors were done by using the two-level full factorial design using design expert® 7 software. The statistical analysis showed that the ethanol yield of (40.91% (g/g)) was obtained at optimised acid hydrolysis variables of 0.5%v/v acid concentration, 5%w/w solid fraction, 105.01°C temperature, and 10 minutes hydrolysis time. Keywords: Prosopis juliflora, pretreatment, hydrolysis, fermentation, 2 level factorial, optimization.

Handbook of Microalgae-Based Processes and Products The Kuala Lumpur International Conference on Biomedical Engineering (BioM ed 2006) was held in December 2006 at the Palace of the Golden Horses, Kuala Lumpur, Malaysia. The papers presented at BioM ed 2006, and published here, cover such topics as Artificial Intelligence, Biological effects of non-ionising electromagnetic fields, Biomaterials, Biomechanics, Biomedical Sensors, Biomedical Signal Analysis, Biotechnology, Clinical Engineering, Human performance engineering, Imaging, Medical Informatics, Medical Instruments and Devices, and many more.

Differential Evolution In Chemical Engineering: Developments And Applications Sustainable Design through Process Integration: Fundamentals and
Applications to Industrial Pollution Prevention, Resource Conservation, and Profitability Enhancement, Second Edition, is an important textbook that provides authoritative, comprehensive, and easy-to-follow coverage of the fundamental concepts and practical techniques on the use of process integration to maximize the efficiency and sustainability of industrial processes. The book is ideal for adoption in process design and sustainability courses. It is also a valuable guidebook to process, chemical, and environmental engineers who need to improve the design, operation, performance, and sustainability of industrial plants. The book covers pressing and high growth topics, including benchmarking process performance, identifying root causes of problems and opportunities for improvement, designing integrated solutions, enhancing profitability, conserving natural resources, and preventing pollution. Written by one of the world’s foremost authorities in integrated process design and sustainability, the new edition contains new chapters and updated materials on various aspects of process integration and sustainable design. The new edition is also packed with numerous new examples and industrial applications. Allows the reader to methodically develop rigorous targets that benchmark the performance of industrial processes then develop cost-effective implementations. Contains state-of-the-art process integration and improvement approaches and techniques including graphical, algebraic, and mathematical methods. Covers topics and applications that include profitability enhancement, mass and energy conservation, synthesis of innovative processes, retrofitting of existing systems, design and
assessment of water, energy, and water-energy-nexus systems, and reconciliation of various sustainability objectives

26th European Symposium on Computer Aided Process Engineering While the PSE community continues its focus on understanding, synthesizing, modeling, designing, simulating, analyzing, diagnosing, operating, controlling, managing, and optimizing a host of chemical and related industries using the systems approach, the boundaries of PSE research have expanded considerably over the years. While early PSE research was largely concerned with individual units and plants, the current research spans wide ranges of scales in size (molecules to processing units to plants to global multinational enterprises to global supply chain networks; biological cells to ecological webs) and time (instantaneous molecular interactions to months of plant operation to years of strategic planning). The changes and challenges brought about by increasing globalization and the common global issues of energy, sustainability, and environment provide the motivation for the theme of PSE2012: Process Systems Engineering and Decision Support for the Flat World. Each theme includes an invited chapter based on the plenary presentation by an eminent academic or industrial researcher Reports on the state-of-the-art advances in the various fields of process systems engineering Addresses common global problems and the research being done to solve them

Ethanol 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.

Biotechnology for Biofuel Production and Optimization. 26th European Symposium on Computer Aided Process Engineering contains the papers presented at the 26th European Society of Computer-Aided Process Engineering (ESCAPE) Event held at Portorož Slovenia, from June 12th to June 15th, 2016. Themes discussed at the conference include Process-product Synthesis, Design and Integration, Modelling, Numerical analysis, Simulation and Optimization, Process Operations and Control and Education in CAPE/PSE. Presents
findings and discussions from the 26th European Society of Computer-Aided Process Engineering (ESCAFE) Event

Sustainability of Products, Processes and Supply Chains

Process Intensification in Chemical Engineering Life-Cycle Assessment of Biorefineries, the sixth and last book in the series on biomass-biorefineries discusses the unprecedented growth and development in the emerging concept of a global bio-based economy in which biomass-based biorefineries have attained center stage for the production of fuels and chemicals. It is envisaged that by 2020 a majority of chemicals currently being produced through a chemical route will be produced via a bio-based route. Agro-industrial residues, municipal solid wastes, and forestry wastes have been considered as the most significant feedstocks for such bio-refineries. However, for the techno-economic success of such biorefineries, it is of prime and utmost importance to understand their lifecycle assessment for various aspects. Provides state-of-art information on the basics and fundamental principles of LCA for biorefineries Contains key features for the education and understanding of integrated biorefineries Presents models that are used to cope with land-use changes and their effects on biorefineries Includes relevant case studies that illustrate main points

20th European Symposium of Computer Aided Process Engineering This book will provide researchers and graduate students with an overview of the recent developments and applications of process
intensification in chemical engineering. It will also allow the readers to apply the available intensification techniques to their processes and specific problems. The content of this book can be readily adopted as part of special courses on process control, design, optimization and modelling aimed at senior undergraduate and graduate students. This book will be a useful resource for researchers in process system engineering as well as for practitioners interested in applying process intensification approaches to real-life problems in chemical engineering and related areas.

Chemical Thermodynamics for Process Simulation
The book deals with the latest research on membrane distillation. New membrane and module designs, low-temperature applications, integration with other membrane units and pilot scale investigations are presented and discussed.

Biofuels Oil palm trunk (OPT) is generated from the replantation of oil palm trees at every 25-30 years interval, left as troublesome waste as it becomes the source of infection to young oil palm trees. This OPT contains a high amount of ready-to-use sugar in the form of sap which can be directly fermented to the most fermentation products. The fermentation process for ethanol production from OPT sap was evaluated in order to produce larger amount of bioethanol. The feasibility of yeast S. cerevisiae to produce bioethanol from OPT sap was investigated along with the effect of different strains of S. cerevisiae and different pretreated mediums. It was proven that yeast S.cerevisiae was able to
produce bioethanol even though the OPT sap undergoes less pretreatment compared to the previous works done by the other researchers. The highest bioethanol yield and productivity had been obtained by using S. cerevisiae Kyokai no.7 in heat sterilized sap. The effects of temperature, initial pH, agitation rate, percentage inoculum and time of incubation were explored using 2-level full factorial design in order to find out the main factor that affecting bioethanol fermentation from the OPT sap. The factors of temperature, initial pH and agitation rate were chosen for optimization study based on the higher percentage contribution (>5 %) and lower p-values.

23 European Symposium on Computer Aided Process Engineering 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 microalgal processes, including techno-economic analysis, process integration, process intensification, life cycle assessment, and exergy analyses.

Life-Cycle Assessment of Biorefineries This book offers the current state of knowledge in the field of biofuels, presented by selected research centers from around the world. Biogas from waste production process and areas of application of biomethane were characterized. Also, possibilities of applications of wastes from
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fruit bunch of oil palm tree and high biomass/bagasse from sorghum and Bermuda grass for second-generation bioethanol were presented. Processes and mechanisms of biodiesel production, including the review of catalytic transesterification process, and careful analysis of kinetics, including bioreactor system for algae breeding, were widely analyzed. Problem of emissivity of NOx from engines fueled by B20 fuel was characterized. The closing chapters deal with the assessment of the potential of biofuels in Turkey, the components of refinery systems for production of biodegradable plastics from biomass. Also, a chapter concerning the environmental conditions of synthesis gas production as a universal raw material for the production of alternative fuels was also added.

Biorefinery of Oil Producing Plants for Value-Added Products Renewable energy is the answer for future energy demand. Renewable energy is the energy that occurs in a natural manner and utilizes unlimited resources. It is the solution for reducing the dependence on fossil fuels and diminishing greenhouse gas emission. It is the key for cleaner, greener, and sustainable energy. In today's world, increased energy needs and environmental and health concerns associated with traditional energy systems have made way for rapid progress in producing energy from renewable resources. However, large-scale integration of current technologies and newer approaches are still required for more efficient and cost-effective systems. This small book is a collection of single research chapters dealing with biofuel generation and some recent methods for grid integration and storage problems. The
editors would like to record their sincere thanks to the authors for their contributions.

Process Synthesis and Process Intensification
Biotechnology for Biofuel Production and Optimization is the compilation of current research findings that cover the entire process of biofuels production from manipulation of genes and pathways to organisms and renewable feedstocks for efficient biofuel production as well as different cultivation techniques and process scale-up considerations. This book captures recent breakthroughs in the interdisciplinary areas of systems and synthetic biology, metabolic engineering, and bioprocess engineering for renewable, cleaner sources of energy. Describes state-of-the-art engineering of metabolic pathways for the production of a variety of fuel molecules Discusses recent advances in synthetic biology and metabolic engineering for rational design, construction, evaluation of novel pathways and cell chassis Covers genome engineering technologies to address complex biofuel-tolerant phenotypes for enhanced biofuel production in engineered chassis Presents the use of novel microorganisms and expanded substrate utilization strategies for production of targeted fuel molecules Explores biohybrid methods for harvesting bioenergy Discusses bioreactor design and optimization of scale-up

Fuel Ethanol Production from Sugarcane ESCAPE-20 is the most recent in a series of conferences that serves as a forum for engineers, scientists, researchers, managers and students from academia and industry to present and discuss progress being made in the area of "Computer Aided Process
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Engineering" (CAPE). CAPE covers computer-aided methods, algorithms and techniques related to process and product engineering. The ESCAPE-20 scientific program reflects the strategic objectives of the CAPE Working Party: to check the status of historically consolidated topics by means of their industrial application and to evaluate their emerging issues. * Includes a CD that contains all research papers and contributions * Features a truly international scope, with guest speakers and keynote talks from leaders in science and industry * Presents papers covering the latest research, key topical areas, and developments in computer-aided process engineering (CAPE)

Lignocellulosic Ethanol Production from a Biorefinery Perspective A comprehensive overview of current developments and applications in biofuels production Process Systems Engineering for Biofuels Development brings together the latest and most cutting-edge research on the production of biofuels. As the first book specifically devoted to process systems engineering for the production of biofuels, Process Systems Engineering for Biofuels Development covers theoretical, computational and experimental issues in biofuels process engineering. Written for researchers and postgraduate students working on biomass conversion and sustainable process design, as well as industrial practitioners and engineers involved in process design, modeling and optimization, this book is an indispensable guide to the newest developments in areas including: Enzyme-catalyzed biodiesel production Process analysis of biodiesel production (including
kinetic modeling, simulation and optimization) The use of ultrasonification in biodiesel production Thermochemical processes for biomass transformation to biofuels Production of alternative biofuels In addition to the comprehensive overview of the subject of biofuels found in the Introduction of the book, the authors of various chapters have provided extensive discussions of the production and separation of biofuels via novel applications and techniques.

Alcohol Fuels This book offers a broad understanding of bioethanol production from sugarcane, although a few other substrates, except corn, will also be mentioned. The 10 chapters are grouped in five sections. The Fuel Ethanol Production from Sugarcane in Brazil section consists of two chapters dealing with the first-generation ethanol Brazilian industrial process. The Strategies for Sugarcane Bagasse Pretreatment section deals with emerging physicochemical methods for biomass pretreatment, and the non-conventional biomass source for lignocellulosic ethanol production addresses the potential of weed biomass as alternative feedstock. In the Recent Approaches for Increasing Fermentation Efficiency of Lignocellulosic Ethanol section, potential and research progress using thermophile bacteria and yeasts is presented, taking advantage of microorganisms involved in consolidating or simultaneous hydrolysis and fermentation processes. Finally, the Recent Advances in Ethanol Fermentation section presents the use of cold plasma and hydrostatic pressure to increase ethanol production efficiency. Also in this
section the use of metabolic-engineered autotrophic cyanobacteria to produce ethanol from carbon dioxide is mentioned.

Thermofluid Modeling for Energy Efficiency Applications Thermofluid Modeling for Sustainable Energy Applications provides a collection of the most recent, cutting-edge developments in the application of fluid mechanics modeling to energy systems and energy efficient technology. Each chapter introduces relevant theories alongside detailed, real-life case studies that demonstrate the value of thermofluid modeling and simulation as an integral part of the engineering process. Research problems and modeling solutions across a range of energy efficiency scenarios are presented by experts, helping users build a sustainable engineering knowledge base. The text offers novel examples of the use of computation fluid dynamics in relation to hot topics, including passive air cooling and thermal storage. It is a valuable resource for academics, engineers, and students undertaking research in thermal engineering. Includes contributions from experts in energy efficiency modeling across a range of engineering fields Places thermofluid modeling and simulation at the center of engineering design and development, with theory supported by detailed, real-life case studies Features hot topics in energy and sustainability engineering, including thermal storage and passive air cooling Provides a valuable resource for academics, engineers, and students undertaking research in thermal engineering

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