Biomass to renewable energy processes pdf

The continued increase in consumption of fossil fuels, the reduction in the availability of easily accessible fossil fuels, the significant contribution to climate change and the price of wildly volatile fuels together call into question the reliability and sustainability of our current energy supply. The possible solution to this energy challenge, biomass energy production, which is heavily dependent on sugar cane and maize production, is subject to fluctuations in the raw material price. New technologies need to be developed for the cost-effective and environmentally friendly conversion of abundant biomass, such as lignocellulosic materials, into energy products. As an introduction to principles and practical applications, biomass describes theories of biological processes, biomass materials and logistics in renewable energy processes, as well as theories on conversion technologies for bioenergy products such as biogas, ethanol, butanol, biodiesel and synthetic gases. The book discusses the anaerobic breakdown of waste materials used for biogas and hydrogen production, bioethanol and starch and cellulose production, as well as biodiesel production from vegetable oils. It deals with thermal processes, including the gasification and pyrolysis of agricultural residues and wooded biomass. The text also covers pre-treatment technologies, enzymatic reactions, fermentation and microbiological metabolisms and pathways. It examines the technical principles of biomass gasification, pyrolysis and possible final products. Editor Jay Cheng compiled the contributors to several engineering disciplines, reflecting the breadth and depth of the field. These experts will discuss the principles of bioenergy production processes, providing the necessary background for the understanding and development of biofuel technologies. They provide the basis for future work and development, which could be a clean, green, renewable, and sustainable energy source for years to come. Biomass for renewable energy processes, Second Edition, explains the theories of biological processes, biomass materials and logistics, and conversion technologies to bioenergy products such as biogas, ethanol, butanol, biodiesel, and synthetic gases. The book discusses the anaerobic breakdown of waste materials used for biogas and hydrogen production, bioethanol and starch and cellulose production, as well as biodiesel production from vegetable oils. It deals with thermal processes, including the gasification and pyrolysis of agricultural residues and wooded biomass. The text also covers pre-treatment technologies, enzymatic reactions, fermentation and microbiological metabolisms and pathways. WithWenqiao Yuan, Ziyu Wang, Deepak R. KeshwaniWithMaurycy Daroch, Jian-Hang Zhu, Fangxiao YangWithWenqiao Yuan, Fangxiao YangWithHasan Jameel, Deepak R. Keshwani Steadily Increased Fossil Fuel Consumption, Decreased Availability Easily fossil fuels, make a significant contribution to climate change and the price of wildly volatile fuels reliability and sustainability of our current energy supply. The possible solution to this energy challenge, biomass energy production, which is heavily dependent on sugar cane and maize production, is subject to fluctuations in the raw material price. New technologies need to be developed for the cost-effective and environmentally friendly conversion of abundant biomass, such as lignocellulosic materials, into energy products. As an introduction to principles and practical applications, biomass describes theories of biological processes, biomass materials and logistics in renewable energy processes, as well as theories on conversion technologies for bioenergy products such as biogas, ethanol, butanol, biodiesel and synthetic gases. The book discusses the anaerobic breakdown of waste materials used for biogas and hydrogen production, bioethanol and starch and cellulose production, as well as biodiesel production from vegetable oils. It deals with thermal processes, including the gasification and pyrolysis of agricultural residues and wooded biomass. The text also covers pre-treatment technologies, enzymatic reactions, fermentation and microbiological metabolisms and pathways. It examines the technical principles of biomass gasification, pyrolysis and possible final products. Editor Jay Cheng compiled the contributors to several engineering disciplines, reflecting the breadth and depth of the field. These experts will discuss the principles of bioenergy production processes, providing the necessary background for the understanding and development of biofuel technologies. They provide the basis for future work and development, which could be a clean, green, renewable, and sustainable energy source for years to come. As evidenced by the increasing energy consumption, public awareness of environmental issues, and strong interest in reducing fossil fuel consumption in both the scientific and industrial sectors worldwide, clean energy is certainly an important scientific topic that requires special attention from the scientific community worldwide. Large amounts of agricultural waste from crop production are promising renewable energy supplies. In this context, bioenergy has been recognized as a major component of many future energy scenarios. Energy waste conversion processes for the production of heat and electricity and transport fuels can have good economic and market potential. Replacing fossil fuels with biofuels seems to be an effective strategy, not only to avert the forthcoming future energy crisis, but also to reduce carbon emissions from fossil fuels. District heating and cooling networks are highly efficient ways of integrating natural resources, such as industrial and agricultural biomass, while increasing energy efficiency. Furthermore, organic products have a lower environmental impact than their fossil and they are a great opportunity because of their entry into the market. Pose. development. Thanks to the creation of local agri-industrial supply chains, the development of marginal or unused land for the production of raw materials of biological origin, which is not in competition with food production and is suitable for converting it into a biochemical system of industrial importance, can certainly give new impetus to the areas from an economic and employment point of view. The main objective of this particular issue will be to analyse the evolution of growing interest and trends in renewable energy and biorefining biomass to help the research community understand the current situation and future trends. Efforts are being made to provide basic information to facilitate decision-making by those responsible for scientific policy. Dr. Giacobbe BraccioDr. Vinod Kumar SharmaGuest Editors Manuscript Submission Information Manuscript Manuscripts Manuscripts must be submitted online www.mdpi.com registration and login to this website. Once registered, click here to go to the submission form. Manuscripts may be submitted by the deadline. We're proofreading every piece of paper. The accepted papers are published continuously in the journal (as soon as they are accepted) and are published together on the diski website. Research articles, review articles, and brief communication are also invited. The planned papers, title and short abstract (about 100 words) can be sent to the Editorial Board for announcement on this website. The manuscripts submitted should not have been published earlier or published elsewhere (except for the conference procedure papers). Each manuscript was thoroughly judged in a one-blind peer review process. Instructions for authors and other relevant information on the submission of manuscripts can be found on the Instructions to Authors page. Processes is an international, peer-reviewed open-access monthly magazine issued by MDPI. Please visit the Authors' Instructions page before submitting the manuscript. The article processing fee (APC) for publication in an open-access journal is CHF 1500 (Swiss francs). Please note that for the 2020 and 2020 years, the commission will be informed of the Papers submitted must be well formatted and use good English. Authors can use MDPI's English editing feature before publishing or when modifying the author. circular economy renewable energy bioenergy advanced biofuel biorefiner energy efficiency The list below contains only the planned manuscripts. Some of the manuscripts have not yet been received by the Editorial Board. Documents submitted to the MDPI logs shall be subject to peer review. Title: RAW GAS CLEANING AND UPGRADING For H2 RICH GAS PRODUCTION: Simulation and Perspective Authors: N. Cerone; E. Catizzone; C. Freda Affiliation: Laboratory thermochemical process biomass, residues and waste valorization, class bioenergy, bio-refinery and green chemistry, ENEA Trisaia Centre, 75026 Rotondella Abstract: Syngas from biomass gasification has been regarded by the scientific community as an intermediate intermediate for both heat and electricity production and the synthesis of chemicals such as hydrogen, DME, methanol and FT hydrocarbons. However, the tar content of raw gas is very harmful to catalytic modernisation systems. In the ENEA, the integrated technology of wet scrubbing for the removal of tar for the repair of raw gas and the transfer of water gas for the production of hydrogen-rich electricity are tested after an experimental upstream gasification (150 kWth). The purpose of this work is to simulate both gas purification and the WGS unit using commercial software based on experimental observations. In this respect, the gas purification unit, i.e. the biodiesel washer), was simulated by an SCDS column, a strict multi-stage steam-liquid equilibrium module operating in a steady state, while the WGS unit was simulated by a kinetic plug-flow reactor. All the design parameters of the units, e.g. biodiesel flow rate, kinetic costants, etc. Experimental data was used to set up and validate accepted models. Keywords. Biomass gasification, syngas, tar removal, catalytic modernisation, wet washing, gas cleaning, design parameters, simulation, model validation. Title: Specific concepts of cleaning and UPGRADIG GAS from BIOMASS GASIFICATION: A.Blasi; M.Morgana; C. Sposato Affiliation: Laboratory thermochemical process biomass, residues and waste valorization class Bioenergy Bioenergy Biorefinery and Green Chemistry ENEA, Research Centre Trisaia, S.S. 106 Ionica, km 419+500 - 75026 Rotondella (MT) Abstract: The aim of this work is to analyse the possible applications of rare earths within the biomass degasification process. In the past, rare earths have been used both as catalysts for desulfurisation of gases produced by coal burning and as catalysts for crack reactions. The research currently focuses on the use of these elements in advanced fumes processes, both as catalysts for the combined shift-methanation process, in gasification of coal products and in the purification of exhaust gases. A full analysis of the potential of these elements through gasification within the energy development processes of biomass is certainly of scientific and industrial importance. Keywords. Rare earths, biomass gasification process, crack reactions, biomass energy repair, gasification processes, scientific and industrial interests. Title: CFD HYDRODYNAMICS INVESTIGATIONS FOR OPTIMUM BIOMASSGASD DESIGN AUTHORS: E. Fanelli Affiliation: Laboratory thermochemical process for biomass, residues and wastes valorization, Division of Bioenergy, Bio-refinery and Green Chemistry, ENEA Trisaia Centre, 75026 Rotondella (MT) — Italy. Abstract: Biomass gasification is now viable option for the production of energy. In addition, more efforts need to be made to available on a commercial scale. The disadvantages that greatly limit the availability - and thus economic feasibility - of the full-time plant mainly concern the sine gas purification of contaminants such as tar. Over the past two decades, different technological approaches have been examined with the aim of increasing both plant availability and overall efficiency by keeping capex and OPEX low. Among the technologies, the fluid bed is certainly the most promising architectures for heat production on a heat scale above 1 MWth. This process involves various engineering aspects: thermo-structural, heat and mass transfer, chemical and liquid dynamic problems are only the most important. In this study, with the aim of achieving optimal reaction chamber design, the hydrodynamics of a bubbling fluidized bed reactor were studied in CFD approach. A eulerian – eulerian multiphasic model was implemented, supported by experimental data to describe the interactions between solid and liquid phases within the reactor, while a DDPM model was considered to examine the exchange of momentum between continuous phases and solid particles simulating biomass. Various process parameters, such as bed recirculation rate and particle residence time inside the bed, have at least been analyzed to characterize the hydrodynamics of the reactor. Keywords. Clean energy, syngas cleaning, efficiency, fluidbed, thermal energy production, design and engineering aspects, heat transfer, fluid dynamics, design process parameter. Title: BIOMASS GASIFICATION: OVERVIEW OF EU EXPERIENCE Authors: Donatella Barisano Affiliation: Division of Bioenergy, Bio-refinery and Green Chemistry, ENEA Trisaia Centre, 75026 Rotondella (MT) — Italy. Abstract: Over time, the European Union has supported and will continue to support the use of biomass in the energy sector as one of the possible measures to counteract the increase in GHG emissions caused by the use of fossil fuels. To this end, a number of processes were considered, of which gasification was also taken into account. As is known, gasification is the thermal chemical process through which solid fuel, such as residual biomass raw materials, can be converted into a much more valuable and flexible gaseous energy source. Depending on the specific process and technology adopted, the gas produced may have different uses. Possible applications of this process have been examined in a number of key sectors, from energy production for stationary use to biofuels involved in transport. In this contribution, you will be given an overview of the different paths identified and the most significant results achieved. Particular attention will be paid to the most mature application, i.e. biomass gasification, in decentralised in order to achieve this. TITLE: CARDOON LIGNOCELLULOSIC BIOMASS BIO-BDO: INTEGRATED INTEGRATED MODEL Authors: Aristide Giuliano; Giovanni Stoppiello; Federico Liuzzi Affiliation: Laboratory bio-refinery and green chemistry, Bioenergy, Bio-refinery and green chemistry, ENEA Trisaia Centre, 75026 Rotondella (NT) – Abstract Italy: Biorefineries are novel production models aimed at bio-based alternatives to many fossil-based products. Biomass supply and energy consumption are important issues that determine the overall sustainability of biorefineries, taking into account the stages of biomass production and collection. Marginal areas should be used to produce the raw material at competitive costs with fossil alternatives. The thistle is highly suited for this purpose, thanks to its low growth times and farm cultivation and harvesting steps. One of the leading companies in this sector, Novamont, has developed in Italy a cardoon based biorefiner. In this value chain, lignocellulose residues represent a plentiful raw material available locally for the production of chemicals and energy-trot lignocellulose biorefiners. In this work, an integrated biorefiner model for bio-based butanediol (bio-BDO) biomass biomass biomass biomass conversion to bio-based butanediol (bio-BDO) will be presented and discussed. After designing the biorefiner process sheet, mass and energy balances were calculated to assess the technical feasibility of the power plant, taking into account the energy needs of power plants (steam and electricity). Finally, in order to assess the environmental impact of the process in terms of carbon footprint, a cradle-to-gate life cycle assessment (LCA) was carried out. Title: INULIN SUBTRACTION FROM THISTLE ROOT AND CONTINUOUS HYDROLYSIS, HETEROGENEOUS CATALYZISSAL WITH ACID RESIN Authors: Isabella De Bari; Federico Luizzi Affiliation: Laboratory of Sustainable Production Development, Division of Bioenergy, Bio-Refinery and Green Chemistry, ENEA Trisaia Centre, 75026 Rotondella (NT) – Italy Abstract: In this work, continuous extraction of einkproduction of sequential hydrolysis fructose has been tested using heterogeneous catalysts, assisting the process by ultrasound. The literature lists the different techniques for extracting inulin from the various raw materials that contain it. Compared to extraction with hot water (80 ° C for 2 hours), many other techniques are designed to make the extraction more efficient and less energy-intensive. Among these, we can mention microwave and ultrasonic assisted extractions, which allow for more effective extraction at reduced time and lower temperatures. In the biorefining area, the improvement of monomer sugars such as fructose requires the hydrolysis process of inulin. Hydrolysis with hydrochloric acid pH 1-2 is the most common technique, but due to the disadvantages of corrosion of plants and environmental influences. In this document, the alternative techniques of hawkish acid with hydrochloric acid were taken into account. Of these, attention is catalysts and the use of on the use of the Dowex Marathon MSC ion exchanger. Therefore, a continuous system has been established that simultaneously operates the extraction and hydrolysis of inulin from thistle roots. The system is also assisted by ultrasound. This includes the use of 2 packed columns containing biomass and cans. The two columns are immersed in an ultrasonic bath and the pump pushes boiling water into them. The system provides continuous flow until the reaction is complete. Title: ARUNDO DONAX REFINING THE SECOND GENERATION BIOETHANOL AND FURFURAL Authors: Isabella De Bari; Federico Luizzi Affiliation: Laboratory of Sustainable Production Development, Division of Bioenergy, Bio-Refinery and Green Chemistry, ENEA Trisaia Centre, 75026 Rotondella (NT) – Italy Abstract: Sugars from biomass are platform molecules that can be converted into different final products. Non-food lignocellulosic raw materials, such as agroforest residues and low inputs, are an attractive bio-source for the production of second-generation sugars. Biorefining systems based on the use of versatile technologies operating under mild conditions contribute to the sustainability of bio-based products. This work describes the conversion of the giant cane (Arundo donax), a non-food plant, to ethanol and furfural (FA). Acid-catalyzed steam explosion was used for biomass pre-treatment and fractionation. Xilose from hemicellulose was dehydrated and furfural dehydrated on a solid acid catalyst in a dual-surface medium irradiated by microwave energy. A number of technological conditions have been studied to achieve the highest ethanol concentration and highest xylod conversion under mild conditions. In particular, a hybrid process for hydrolysis and fermentation of carbohydrates under high gravitational conditions was investigated. In particular, the bio-transformation of pre-treated Arundo donax into bioethanol examined the effect of temperature modulation between 50°C and 32°C. The results show that hybrid hydrolysis and fermentation of giant cane hydrates resulted in x% more ethanol than the reference process. Optimal liquefaction time before SSF using Y-hour 100 mgCTEC3/gglucan. Work at pH 5.5 allowed for greater cellular solvency at 37°C. Separate processing of C6 and C5 currents resulted in 51 g/l of ethanol from C6 (66% of the theoretical yield) and 48% FA from the theoretical value after 10 minutes of microwave heating at 150 °C.