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Judul Jurnal Ilmiah (Artikel)	:	Biogas Production from Coffee Pulp and Chicken Feathers Using Liquid- and Solid-State Anaerobic Digestions
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Status Pengusul	:	Penulis pertama~~/ penulis ke - 3/~~ penulis korespondensi
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c. Kecukupan dan kemutakhiran data/ informasi dan metodologi (30%)	11,00	11,00	11,00
d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)	9,00	9,00	9,00
Total = (100%)	**34,00**	**35,00**	**34,50**
Nilai Pengusul (60% x nilai total)	**20,40**	**21,00**	**20,70**

Semarang, 10 Agustus 2021

Reviewer II

Prof. Nita Aryanti, ST, MT, PhD
NIP. 197501172000032001
Unit Kerja : Departemen Teknik Kimia FT Undip

Reviewer I

Prof. Dr. Mohamad Djaeni, ST, M,Eng
NIP. 197102071995121001
Unit Kerja : Departemen Teknik Kimia FT Undip

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c. Kecukupan dan kemutakhiran data/ informasi dan metodologi (30%)	12,00			11,00
d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)	12,00			9,00
Total = (100%)	**40,00**			**34,00**
Nilai pengusul = 60% x 34,00 = 20,40				

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Artikel ini dipublikasikan lengkap dengan bagian terdiri dari: Judul, Abstrak, Pendahuluan, Bahan dan Metode, Hasil dan Pembahasan, Kesimpulan, Ucapan Terima Kasih, dan Daftar Pustaka. Artikel ditulis sesuai dengan petunjuk penulisan Jurnal. Substansi artikel sesuai dengan bidang ilmu Teknik Kimia.

2. Ruang lingkup dan kedalaman pembahasan:
Substansi artikel sesuai dengan bidang ilmu pengusul, yaitu Teknik Kimia. Kebaruan artikel ini membahas secara komprehensif mengenai pengaruh prosentase TS dan rasio C/N pada penurunan COD laju produksi biogas. Pembahasan cukup komprehensif dan disertai dengan referensi yeng memadai. Hasil dibahas dengan cukup detail dalam bentuk 11 grafik dan 1 tabel disertai referensi yang memadai dalam hasil dan pembahasan sebanyak 35 dari 57 referensi yang digunakan (61,4 %). Penurunan BOD/COD sangat signifikan, namun informasi komposisi biogas yang dihasilkan tidak ditampilkan.

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:
Kemutakhiran data didukung referensi yaitu 10 tahun terakhir sebanyak 52 dari 57 artikel yang disitasi, atau 91,23 %. Metode penelitian dituliskan cukup komprehensif disertai dengan analisis statistik sederhana dan memenuhi standar penulisan jurnal tersebut. Penyajian data cukup lengkap didukung Pemodelan Gompert untuk memprediksi laju produksi biogas.

4. Kelengkapan unsur dan kualitas terbitan:
Jurnal diterbitkan oleh Multidisciplinary Digital Publishing Institute (MDPI), masuk dalam kategori jurnal terindeks SCOPUS Q2 dengan SJR = 0,6 (2020), H index=93, dan Impact Factor 3,004 (2020) namun masuk kategori cukup dengan banyaknya terbitan 329 tiap issue. Artikel memiliki similaritas turnitin 11 %. Jurnal terindeks di Scopus (Elsevier), Scimagojr/SCIE-Science Citation Index Expanded (Clarivate/ Thomson Reuters).

Semarang,
Reviewer I

Prof. Dr. Mohamad Djaeni, ST, M,Eng
NIP. 197102071995121001
Unit Kerja : Departemen Teknik Kimia FT Undip

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d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)	12,00			9,00
Total = (100%)	**40,00**			**35,00**
Nilai pengusul = 60% x 35,00 = 21,00				

Catatan penilaian artikel oleh Reviewer:

1. Kesesuaian dan kelengkapan unsur isi iurnal:

Kesesuaian dan unsur isi artikel lengkap sesuai dengan bidang ilmu Teknik Kimia. Artikel ditulis sesuai dengan panduan penulisan jurnal yang tersaji dengan baik, terdiri dari judul, abstrak, pendahuluan, bahan dan metode, hasil dan pembahasan, kesimpulan, ucapan terima kasih serta daftar pustaka.

2. Ruang lingkup dan kedalaman pembahasan:

Ruang lingkup artikel mengkaji secara komprehensif produksi biogas berbahan baku limbah kopi dan bulu ayam dengan variabel prosentase TS dan rasio C/N terhadap laju produksi biogas. Pembahasan cukup komprehensif dan disertai dengan referensi yang memadai. Pembahasan menggunakan 35 referensi dari total 57 (61,4%). Pembahasan dilengkapi dengan 1 tabel dan 11 grafik sehingga menunjukkan kedalaman pembahasan yang baik.

3. Kecukupan dan kemutakhiran data/infrmasi dan metodologi:

Penyajian metodologi dan data cukup lengkap dituliskan dalam beberapa sub bagian. Metodologi didukung oleh oleh Pemodelan Gompert untuk memprediksi laju produksi biogas. Kemutakhiran artikel yang baik dibuktikan sebanyak 52 dari 57 artikel (91,23%) merupakan referensi dalam 10 tahun terakhir.

4. Kelengkapan unsur dan kualitas terbitan:

Jurnal Energies diterbitkan oleh Multidisciplinary Digital Publishing Institute (MDPI) dengan Impact Factor 3,004 (2020), masuk dalam kategori jurnal terindeks SCOPUS Q2 dengan SJR = 0,6, H index=93. Artikel memiliki similaritas turnitin 11 %. Editorial board terdiri dari 30 negara dengan penulis dari banyak negara. Jurnal dilengkapi petunjuk penulisan yang jelas, namun kualitas jurnal kategori cukup dengan 329 terbitan dalam satu Issue.

Semarang,
Reviewer II

Prof. Nita Aryanti, ST, MT, PhD
NIP. 197501172000032001
Unit Kerja : DepartemenTeknik Kimia FT Undip

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Biogas production from coffee pulp and chicken feathers using liquid-and solid-state anaerobic digestions

Sumardiono S. , Jos B. , Dewanti A.A.E. , Mahendra I. , Cahyono H.

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Department of Chemical Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, 50239, Indonesia

Abstract

Agricultural waste, particularly lignocellulose, has been used in the second generation of biogas. Coffee pulp and chicken feathers can be developed as biogas raw materials because of their suitability as a biogas substrate. This study investigates the effect of the percentage of total solids (TS), carbon to nitrogen ratio (C/N, g/g), and delignification pretreatment on biogas production from coffee pulp and chicken feathers, and aims to compose kinetics using the modified Gompertz model. The results show that adjusting the percentage of TS at low-level speeds up the degradation process, which increases chemical oxygen demand (COD) reduction and biogas production. COD reduction and biogas production increase optimally at the 25 (g/g) C/N ratio. Pretreatment delignification aids microorganisms in substrate decomposition, resulting in faster COD reduction and biogas conversion. The 25% TS and 25 (g/g) C/N ratio with the delignification process achieved the best biogas production, with biogas production of 10,438.04 mL. The Gompertz method shows that the difference in TS percentage can influence biogas production. Moreover, the method shows that biogas production is higher with the delignification process than without it. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Author keywords

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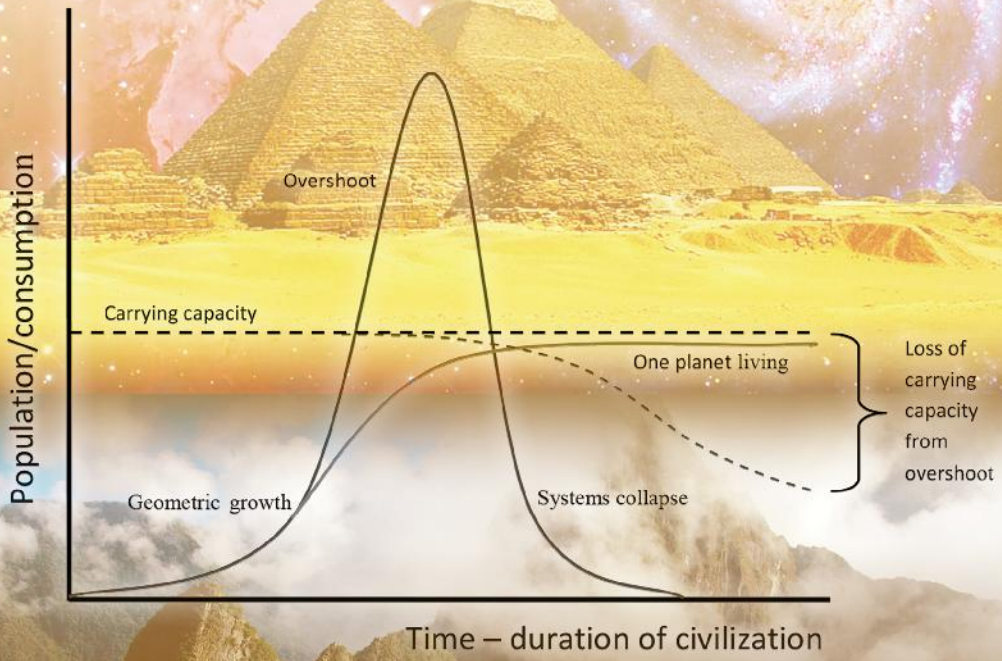

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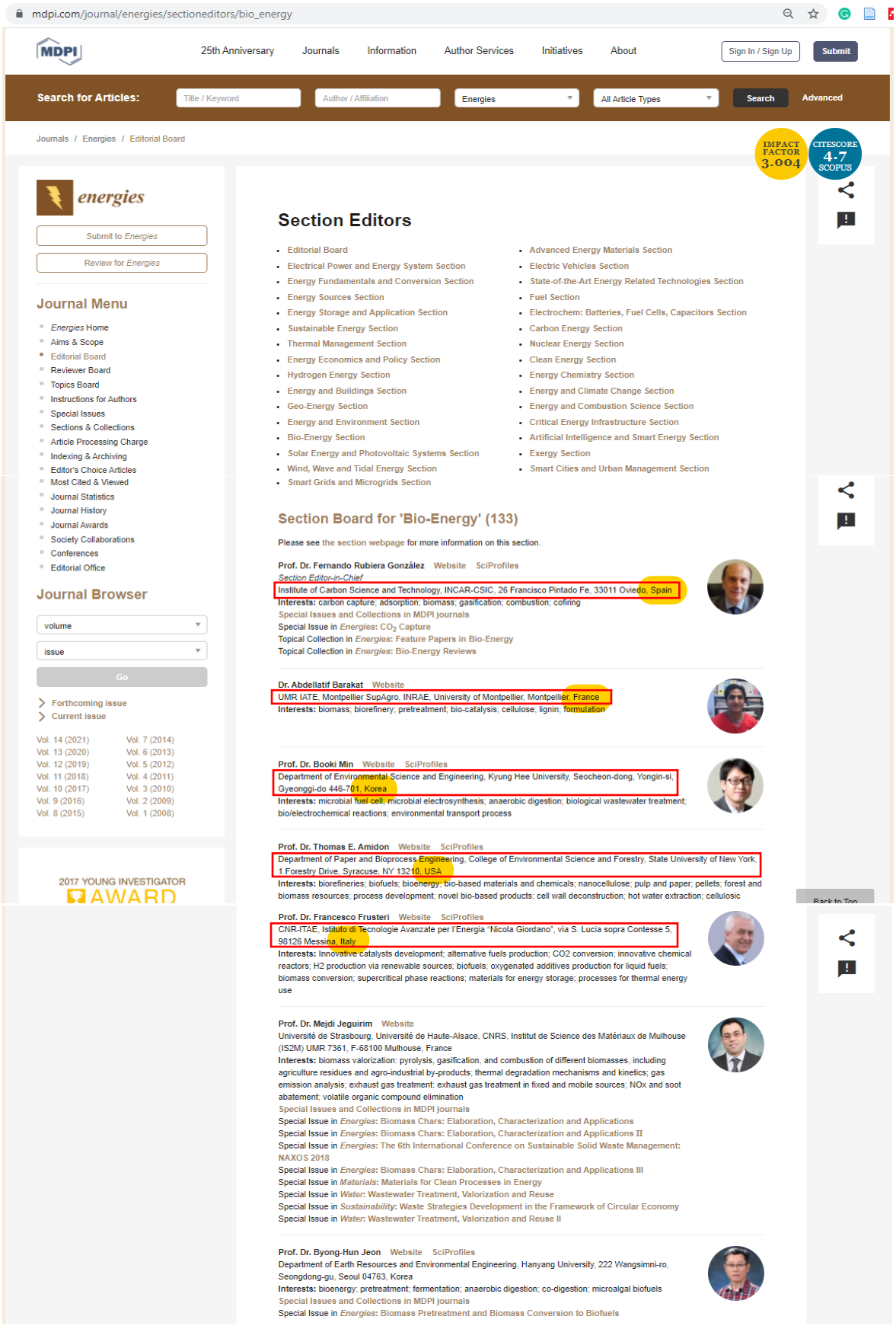

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Interests: biomass; biorefinery; pretreatment; bio-catalysis; cellulose; lignin; formulation

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Department of Environmental Science and Engineering, Kyung Hee University, Seocheon-dong, Yongin-si, Gyeonggi-do 446-701, Korea
Interests: microbial fuel cell; microbial electrosynthesis; anaerobic digestion; biological wastewater treatment; bio/electrochemical reactions; environmental transport process

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Department of Paper and Bioprocess Engineering, College of Environmental Science and Forestry, State University of New York, 1 Forestry Drive, Syracuse, NY 13210, USA
Interests: biorefineries; biofuels; bioenergy; bio-based materials and chemicals; nanocellulose; pulp and paper; pellets; forest and biomass resources; process development; novel bio-based products; cell wall deconstruction; hot water extraction; cellulosic

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CNR-ITAE, Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano", via S. Lucia sopra Contesse 5, 98126 Messina, Italy
Interests: innovative catalysts development; alternative fuels production; CO2 conversion; innovative chemical reactors; H2 production via renewable sources; biofuels; oxygenated additives production for liquid fuels; biomass conversion; supercritical phase reactions; materials for energy storage; processes for thermal energy use

Prof. Dr. Mejdi Jeguirim Website
Université de Strasbourg, Université de Haute-Alsace, CNRS, Institut de Science des Matériaux de Mulhouse (IS2M) UMR 7361, F-68100 Mulhouse, France
Interests: biomass valorization: pyrolysis, gasification, and combustion of different biomasses, including agriculture residues and agro-industrial by-products; thermal degradation mechanisms and kinetics; gas emission analysis; exhaust gas treatment: exhaust gas treatment in fixed and mobile sources; NOx and soot abatement; volatile organic compound elimination
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Prof. Dr. Byong-Hun Jeon Website SciProfiles
Department of Earth Resources and Environmental Engineering, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 04763, Korea
Interests: bioenergy; pretreatment; fermentation; anaerobic digestion; co-digestion; microalgal biofuels
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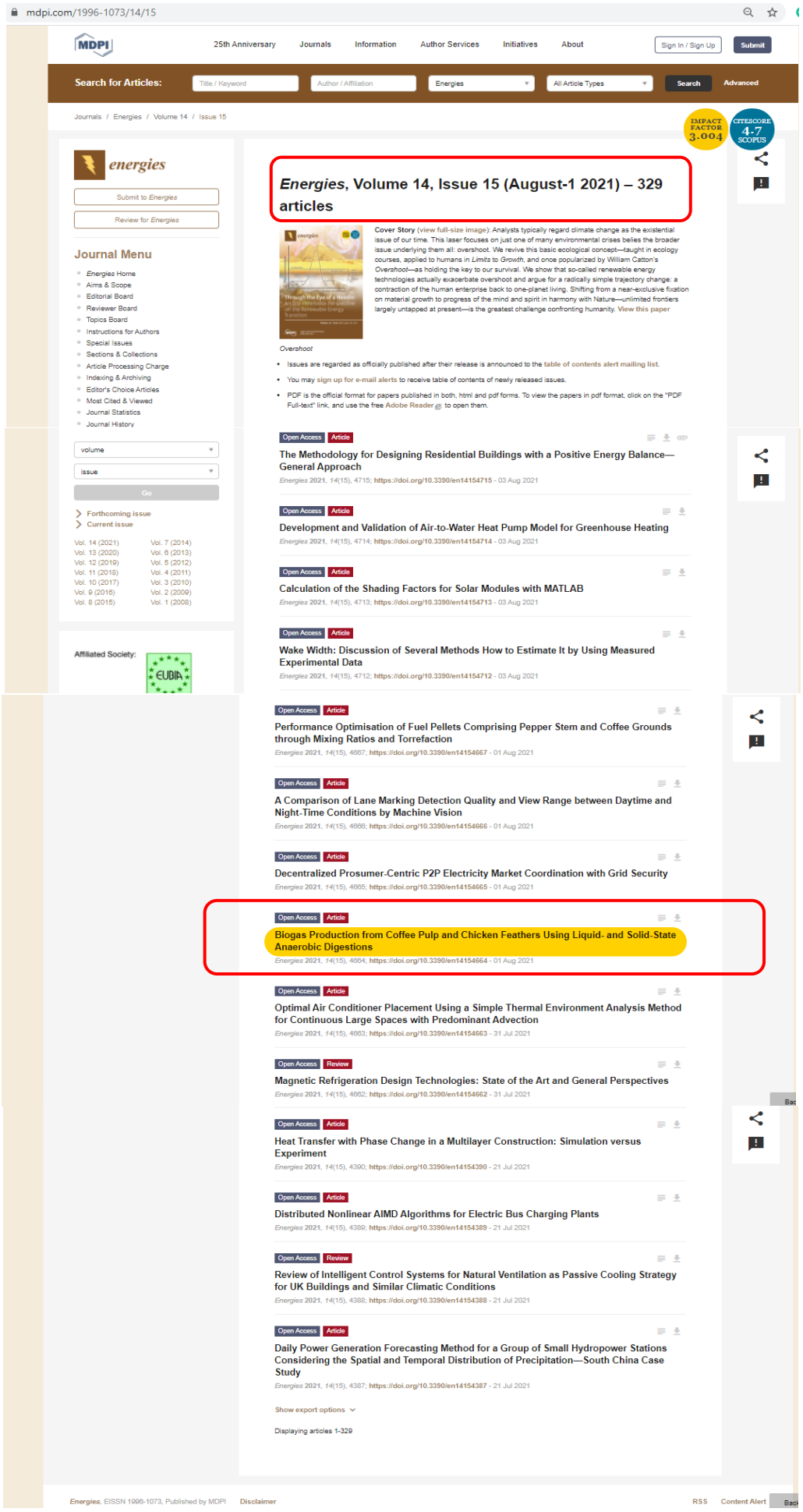

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Article

Biogas Production from Coffee Pulp and Chicken Feathers Using Liquid- and Solid-State Anaerobic Digestions

Siswo Sumardiono *, Bakti Jos, Agata Advensia Eksa Dewanti, Isa Mahendra and Heri Cahyono

Department of Chemical Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang 50239, Indonesia; baktijos10@gmail.com (B.J.); agataadven@gmail.com (A.A.E.D.); isamahendra6996@gmail.com (I.M.); hericahyono@che.undip.ac.id (H.C.)

* Correspondence: siswo.sumardiono@che.undip.ac.id; Tel.: +62-(24)-7460058

Abstract: Agricultural waste, particularly lignocellulose, has been used in the second generation of biogas. Coffee pulp and chicken feathers can be developed as biogas raw materials because of their suitability as a biogas substrate. This study investigates the effect of the percentage of total solids (TS), carbon to nitrogen ratio (C/N, g/g), and delignification pretreatment on biogas production from coffee pulp and chicken feathers, and aims to compose kinetics using the modified Gompertz model. The results show that adjusting the percentage of TS at low-level speeds up the degradation process, which increases chemical oxygen demand (COD) reduction and biogas production. COD reduction and biogas production increase optimally at the 25 (g/g) C/N ratio. Pretreatment delignification aids microorganisms in substrate decomposition, resulting in faster COD reduction and biogas conversion. The 25% TS and 25 (g/g) C/N ratio with the delignification process achieved the best biogas production, with biogas production of 10,438.04 mL. The Gompertz method shows that the difference in TS percentage can influence biogas production. Moreover, the method shows that biogas production is higher with the delignification process than without it.

Keywords: biogas production; chicken feathers; coffee pulp; liquid-state anaerobic digestion; solid-state anaerobic digestion

Citation: Sumardiono, S.; Jos, B.; Dewanti, A.A.E.; Mahendra, I.; Cahyono, H. Biogas Production from Coffee Pulp and Chicken Feathers Using Liquid- and Solid-State Anaerobic Digestions. *Energies* **2021**, *14*, 4664. https://doi.org/10.3390/en14154664

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1. Introduction

Energy sustainability is one of the significant issues in this era. Based on the British Petroleum (BP) Statistical Review of World Energy, global energy needs are linear with the number of births, which means that energy consumption increases every year because of the world population growth [1]. Global energy development is in the process of transitioning into renewable energy [2]. Renewable energy is produced from biomass, water, photovoltaic solar, and geothermal sources [3], including biogas. Biogas mainly contains methane and carbon dioxide, hydrogen, hydrogen sulfide, nitrogen, and oxygen in minor quantities [4]. Biogas is produced from farm waste, such as cow manure [5], cabbage waste, chicken feces [6]. Another potential waste raw material for biogas production is food industry waste [7].

Coffee is one of the largest commodities in world trade after crude oil. Coffee pulp waste has a good fiber and protein content of 17% and 10.4%, respectively, and is processed for another purpose [8]. Chicken feathers are another potential protein source because they contain 85–95% of protein [9]. Ruminants cannot digest undegradable protein of 53.6–87.9% from chicken feathers. Anaerobic digestion is a biochemical decomposition process using anaerobic microorganisms in an anaerobic condition, which means no oxygen is needed. Anaerobic digestion is divided into two major types: liquid-state anaerobic digestion (LS-AD) and solid-state anaerobic digestion (SS-AD). Both methods demonstrate a good result in biogas formation. In previous research by Manan and Webb, the water content in SS-AD was in the range of 12–70%, whereas LS-AD is different and needs more

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Article

Bio-Crude Production Improvement during Hydrothermal Liquefaction of Biopulp by Simultaneous Application of Alkali Catalysts and Aqueous Phase Recirculation

Komeil Kohansal [1], Kamaldeep Sharma [1], Saqib Sohail Toor [1], Eliana Lozano Sanchez [1], Joscha Zimmermann [2], Lasse Aistrup Rosendahl [1] and Thomas Helmer Pedersen [1,*]

[1] Department of Energy Technology, Aalborg University, Pontoppidanstræde 111, 9220 Aalborg, Denmark; kks@et.aau.dk (K.K.); ksh@et.aau.dk (K.S.); sst@et.aau.dk (S.S.T.); els@et.aau.dk (E.L.S.); lar@et.aau.dk (L.A.R.)

[2] Institute of Catalysis Research and Technology (IKFT), Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany; joscha.zimmermann@kit.edu

* Correspondence: thp@et.aau.dk; Tel.: +45-2829-1679

Abstract: This study focuses on the valorization of the organic fraction of municipal solid waste (biopulp) by hydrothermal liquefaction. Thereby, homogeneous alkali catalysts (KOH, NaOH, K_2CO_3, and Na_2CO_3) and a residual aqueous phase recirculation methodology were mutually employed to enhance the bio-crude yield and energy efficiency of a sub-critical hydrothermal conversion (350 °C, 15–20 Mpa, 15 min). Interestingly, single recirculation of the concentrated aqueous phase positively increased the bio-crude yield in all cases, while the higher heating value (HHV) of the bio-crudes slightly dropped. Compared to the non-catalytic experiment, K_2CO_3 and Na_2CO_3 effectively increased the bio-crude yield by 14 and 7.3%, respectively. However, KOH and NaOH showed a negative variation in the bio-crude yield. The highest bio-crude yield (37.5 wt.%) and energy recovery (ER) (59.4%) were achieved when K_2CO_3 and concentrated aqueous phase recirculation were simultaneously applied to the process. The inorganics distribution results obtained by ICP reveal the tendency of the alkali elements to settle into the aqueous phase, which, if recovered, can potentially boost the circularity of the HTL process. Therefore, wise selection of the alkali catalyst along with aqueous phase recirculation assists hydrothermal liquefaction in green biofuel production and environmentally friendly valorization of biopulp.

Keywords: hydrothermal liquefaction; municipal solid waste; biopulp; alkali catalyst; aqueous phase recirculation

Citation: Kohansal, K.; Sharma, K.; Toor, S.S.; Sanchez, E.L.; Zimmermann, J.; Aistrup Rosendahl, L.; Pedersen, T.H. Bio-Crude Production Improvement during Hydrothermal Liquefaction of Biopulp by Simultaneous Application of Alkali Catalysts and Aqueous Phase Recirculation. *Energies* **2021**, *14*, 4492. https://doi.org/10.3390/en14154492

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1. Introduction

In recent decades, urbanization and increasing population density in urban areas have resulted in a surge in municipal solid waste (MSW) generation [1]. Whereas the nowadays global MSW production capacity is approximately 2.01 billion tons per year (2016), predicted by the World Bank Group, this number is estimated to increase further by 70% to 3.40 billion metric tons by 2030 [2–4]. On the other hand, waste treatment facilities have not progressed at the same pace, and henceforth their lack of capacity can lead to catastrophic environmental issues. Depending on the region, around 28–58% of the produced MSW by most countries consists of organic waste [5]. Thus far, this type of residue has been viewed as the bothersome part of MSW that can hamper the usage of recycling technologies, but, at the same time, it represents a sustainable source of carbon exploitable for liquid fuels and nutrients for agriculture. The organic fraction of MSW contains a considerable moisture content, making valorization techniques such as incineration cost-prohibitive. Moreover, being exposed to non-biodegradable materials such as polymers, it is often contaminated by a significant amount of macro- and microplastics that can

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Article

Cultivation of Autochthonous Microalgae for Biomass Feedstock: Growth Curves and Biomass Characterization for Their Use in Biorefinery Products

Juan Félix González [1,*], Teresa Belén Cuello [1], Antonio José Calderón [2], Manuel Calderón [2], Jerónimo González [3] and Diego Carmona [2]

[1] Department of Applied Physics, School of Industrial Engineering, University of Extremadura, 06006 Badajoz, Spain; becuho@hotmail.com
[2] Department of Electric, Electronic and Automatic Engineering, University of Extremadura, Avda. Elvas, s/n, 06006 Badajoz, Spain; ajcalde@unex.es (A.J.C.); calgodoy@unex.es (M.C.); dcarmona@unex.es (D.C.)
[3] Extensive Crops Department, Biofuels, CICYTEX, Counseling Employment, Enterprise and Innovation, Extremadura Government, Finca La Orden, Guadajira, 06187 Badajoz, Spain; jeronimo.gonzalez@juntaex.es
* Correspondence: jfelixgg@unex.es

Abstract: In this work, the biomass productivity for biorefinery products and growth curves of three autochthonous microalgae collected in different reservoirs ("*Scenedesmus* sp." (SSP), mixture of *Scenedesmus* sp., *Chlorella minutissima*, *Chlorellas* sp. and *Nannochloropsis* sp. named "*La Orden*" (LO) consortium and *Chlorella minutissima* named "*Charca Brovales*" (CB) consortium) were studied in a 5.5 L column laboratory photobioreactor. Two different culture media, Arnon culture (AM) and an agriculture fertilizer-based liquid medium (FM), have been used to evaluate the growth effect of the microalgae; it was found that the medium has a clear effect on the biomass productivity and growth rate, which ranged between 0.26–0.498 g L^{-1} d^{-1} and 0.288–0.864 d^{-1}, respectively. In general, the elemental analysis and higher heating value of microalgae biomass for the three species were independent of the culture medium used for its growth, while their lipids and sugars content depended upon the species type and culture medium used in the cultivation. "*La Orden*" microalga was selected (given its best adaption to the climatic conditions) to study the biomass productivity and growth rate in two exterior photobioreactors (100 L column and 400 L flat panel), using FM as a medium, obtaining values of 0.116–0.266 g L^{-1} d^{-1} and 0.360–0.312 d^{-1}, respectively. An automation and control system was designed to operate the exterior photobioreactors pilot plant. The lipid content of this microalga in these photobioreactors was lower than in the laboratory one, with a fatty acids profile with predominantly palmitic, oleic, linoleic and linolenic acids. Also, the fresh biomass collected from these photobioreactors was studied in a batch type digestion process for biogas production, obtaining a CH_4 yield of 296 ± 23 L CH_4 kg_{VSS}^{-1} added with a reduction in percentage of COD and vs. of 50 ± 1% and 50 ± 1.7%, respectively.

Keywords: autochthonous microalgae; culture medium; biorefinery; biomass production; biofuels

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1. Introduction

The 2030 climate and energy framework sets targets for cutting greenhouse gas emissions and increasing the share of renewable energy and energy efficiency [1]. Under the energy union, the EU is working to integrate Europe's energy markets, ensure energy security, improve energy efficiency and decarbonize the economy. In this sense, in the last years, the biorefinery concept has been implemented. According to this concept, a system must guarantee a unified approach in the generation of valuable materials and biofuels via the integration of biomass conversion processes [2]. A quite complete review has been published describing the possible conversion technologies to transform meat processing waste into biochemicals and biofuels [3]. In this line, alternative renewable

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Organic-Inorganic Novel Green Cation Exchange Membranes for Direct Methanol Fuel Cells

Marwa H. Gouda [1], Tamer M. Tamer [1,*], Abdelaziz H. Konsowa [2], Hassan A. Farag [2] and Mohamed S. Mohy Eldin [1,*]

[1] Polymer Materials Research Department, Advanced Technology and New Materials Research Institute (ATNMRI), City of Scientific Research and Technological Applications City (SRTA-City), Alexandria 21934, Egypt; marwagouda777@yahoo.com

[2] Chemical Engineering Department, Faculty of Engineering, Alexandria University, Alexandria 21544, Egypt; akonsowa@alexu.edu.eg (A.H.K.); abualy2125@yahoo.com (H.A.F.)

* Correspondence: ttamer85@gmail.com (T.M.T.); mohyeldinmohamed@yahoo.com (M.S.M.E.)

Abstract: Commercializing direct methanol fuel cells (DMFC) demands cost-effective cation exchange membranes. Herein, a polymeric blend is prepared from low-cost and eco-friendly polymers (i.e., iota carrageenan (IC) and polyvinyl alcohol (PVA)). Zirconium phosphate ($ZrPO_4$) was prepared from the impregnation–calcination method and characterized by energy dispersive X-ray analysis (EDX map), X-ray diffraction analysis (XRD), Fourier transform infrared spectroscopy (FTIR), and transmission electron microscopy (TEM), then incorporated as a bonding and doping agent into the polymer blend with different concentrations. The new fabricated membranes were characterized by SEM, FTIR, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and XRD. The results revealed that the membranes' physicochemical properties (oxidative stability, tensile strength) are enhanced with increasing doping addition, and they realized higher results than Nafion 117 because of increasing numbers of hydrogen bonds fabricated between the polymers and zirconium phosphate. Additionally, the methanol permeability was decreased in the membranes with increasing zirconium phosphate content. The optimum membrane with IC/SPVA/$ZrPO_4$-7.5 provided higher selectivity than Nafion 117. Therefore, it can be an effective cation exchange membrane for DMFCs applications.

Keywords: carrageenan; poly(vinyl alcohol); cation exchange membrane; direct methanol fuel cell; zirconium phosphate

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1. Introduction

Fuel cells are utilized to directly transform the chemical reaction into electrical power. There are many kinds of fuel cells, such as methanol, ethanol, hydrogen, etc., and they achieve low pollution [1]. The DMFC, as a class of H exchange membrane fuel cells (PEMFC), is broadly used in home appliances, automobiles, aerospace, and other areas [2].

The membrane works as a separator between the methanol and oxidant and provides the chance for ions' conduction in the fuel cell. Nafion membranes are the most perfluorinated PEMs used in the DMFCs due to their good ionic conductivity and chemical and mechanical stability [1,3], although their preparation requires high costs and complex steps [4,5]. Their substitution by inexpensive and green membranes is essential [6–8].

Scientists develop fuel cell membranes via sulfonation of polymers, blending [9], or adding a doping agent. Materials with functionalizing carbon and porous and functionalized inorganic materials have been used with membranes to replace Nafion membranes [9,10]. Non-perfluorinated polymers, such as poly(ether ether ketone), poly(styrene), and poly(benzimidazole), are the polymers commonly used for the preparation of novel alternative membranes [10–12]. Preparation of these non-degradable polymers demands a long time, toxic solvents, and high temperature, making the membranes' fabrication costly, complicated, and not green. From an economic and technological perspective, using green,