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**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**  
**KARYA ILMIAH: JURNAL ILMIAH**

Judul Jurnal Ilmiah (Artikel) : Effects of Pretreatment and Ratio of Solid Sago Waste to Rumen on Biogas Production through Solid-State Anaerobic Digestion

Jumlah Penulis : 5 orang

Status Pengusul : Penulis pertama/penulis ke-3/ penulis korespondensi

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- b. Nomor ISSN : 2071-1050
- c. Volume, nomor, bulan, tahun : Vol. 13, No. 13, Juli 2021
- d. Penerbit : Multidisciplinary Digital Publishing Institute (MDPI)
- e. DOI Artikel : 10.3390/su13137491
- f. Alamat web Jurnal : <https://www.mdpi.com/journal/sustainability>
- Alamat artikel : <https://www.mdpi.com/2071-1050/13/13/7491>
- g. Terindeks : SCOPUS (Q2: Renewable Energy, Sustainability and the Environment), SJR=0,61 (2020)

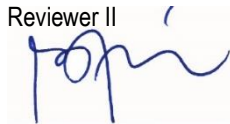
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b. Ruang lingkup dan kedalaman pembahasan (30%)	10,00	10,00	10,00
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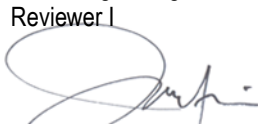
Reviewer II



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

Semarang, 10 Agustus 2021

Reviewer I



Prof. Dr. Mohamad Djaeni, ST, M,Eng  
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d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)	12,00			9,00
<b>Total = (100%)</b>	<b>40,00</b>			<b>33,00</b>
<b>Nilai pengusul = 60% x 33,00 = 19,80</b>				

**Catatan penilaian artikel oleh Reviewer:**

**1. Kesesuaian dan kelengkapan unsur isi jurnal:**

Artikel ini dipublikasikan lengkap dengan bagian terdiri dari: Judul, Abstrak, Pendahuluan, Bahan dan Metode, Hasil, 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 dan kebaruan artikel ini membahas tentang produksi biogas berbahan baku limbah padat sago dengan kandungan lignin tinggi. Hasil dan pembahasan ditulis terpisah cukup komprehensif dilengkapi dengan 14 grafik dan didukung referensi yang memadai sebanyak 26 dari 48 referensi (54,2%) digunakan dalam pembahasan. Data-data cukup banyak namun data mengenai kemurnian dan komposisi biogas yang dihasilkan perlu diekspose untuk memastikan gasnya bisa digunakan.

**3. Kecukupan dan kemutakhiran data/informasi dan metodologi:**

Kemutakhiran data didukung referensi yaitu 10 tahun terakhir sebanyak 35 dari 48 artikel yang disitasi, atau 73 %. Metode penelitian dituliskan cukup komprehensif disertai dengan analisis statistik sederhana dan memenuhi standar penulisan jurnal tersebut. Penyajian data cukup lengkap didukung pemodelan laju produksi biogas.

**4. Kelengkapan unsur dan kualitas terbitan:**

Jurnal diterbitkan oleh Multidisciplinary Digital Publishing Institute (MDPI), masuk dalam kategori jurnal terindeks SCOPUS Q1 dengan SJR = 0,61 (2020), H index=85, dan Impact Factor 3,251 (2020), namun masuk kategori kualitas terbitan cukup dengan banyaknya terbitan 533 tiap issue. Artikel memiliki similaritas turnitin 13 %. Jurnal terindeks di Scopus (Elsevier), Scimagojr/SCIE-Science Citation Index Expanded (Clarivate Analytics/ 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
<b>Total = (100%)</b>	<b>40,00</b>			<b>34,00</b>
<b>Nilai pengusul = 60% x 34,00 = 20,40</b>				

**Catatan penilaian artikel oleh Reviewer:**

**1. Kesesuaian dan kelengkapan unsur isi jurnal:**

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, pembahasan, kesimpulan, ucapan terima kasih serta daftar pustaka.

**2. Ruang lingkup dan kedalaman pembahasan:**

Ruang lingkup artikel mengkaji produksi biogas berbahan baku limbah padat sago yang mengandung linoselulosa. Kedalaman pembahasan baik dan dilengkapi 14 grafik dan 1 tabel dan disertai dengan referensi yang memadai. Pembahasan menggunakan 26 referensi dari total 48 (54,2%).

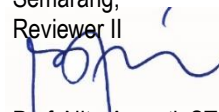
**3. Kecukupan dan kemutakhiran data/infrmasi dan metodologi:**

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 35 dari 48 artikel (73%) merupakan referensi dalam 10 tahun terakhir..

**4. Kelengkapan unsur dan kualitas terbitan:**

Jurnal Sustainability diterbitkan oleh Multidisciplinary Digital Publishing Institute (MDPI) dengan Impact Factor 3,251 (2020), masuk dalam kategori jurnal terindeks SCOPUS Q1 dengan SJR = 0,61, H index=85. Editorial board terdiri dari 28 negara, namun kualitas penerbit kategori cukup dengan 24 issue tiap tahun. Artikel memiliki similaritas turnitin 13 %. Penulis berasal dari banyak negara dengan distribusi berasal Cina, Itali, Inggris, Amerika, Korea, Malaysia, Iran, Jerman, Australia, Jepang, Taiwan, Pakistan, Indonesia, Romania, dll.

Semarang,  
Reviewer II



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# Effects of pretreatment and ratio of solid sago waste to rumen on biogas production through solid-state anaerobic digestion

[Sumardiono S.](#) ✉️, [Adisukmo G.](#) ✉️, [Hanif M.](#) ✉️, [Budiyono B.](#) ✉️, [Cahyono H.](#) ✉️

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## Abstract

Solid sago waste is a potential source of producing renewable energy in the form of biogas. This study investigated the effects of solid sago waste particle size, biological pretreatment using a microbial consortium of lignocelluloses, pretreatment with NaOH, and the ratio between solid sago waste and cow rumen based on the biogas production rate. Several variations of these conditions were used to achieve this. The anaerobic digestion process was conducted over two months at  $30.42^{\circ}\text{C} \pm 0.05^{\circ}\text{C}$ , and the biogas production rate was measured every two days. The 1:1 ratio showed better results compared to the 2:1, because it allows the bacteria to achieve metabolic balance. The highest cumulative biogas production (27.91 mL/g TS) was generated when the sago waste underwent milling ( $\pm 1$  mm), pretreatment with 4% NaOH g/g TS, and treatment with microbial consortium 5% v/v at a 1:1 ratio of solid sago waste to the rumen. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

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Dr. Ioanna Ntaikou Website SciProfiles  
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Interests: fermentation; biofuels and biomolecules production via microbial processes (biohydrogen, bioethanol, polyhydroxyalkanoates, antioxidants); biological and thermochemical fractionation of lignocellulose; recovery of nutrients from wastes; risk assessment  
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## Article

# Effects of Pretreatment and Ratio of Solid Sago Waste to Rumen on Biogas Production through Solid-State Anaerobic Digestion

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**Abstract:** Solid sago waste is a potential source of producing renewable energy in the form of biogas. This study investigated the effects of solid sago waste particle size, biological pretreatment using a microbial consortium of lignocelluloses, pretreatment with NaOH, and the ratio between solid sago waste and cow rumen based on the biogas production rate. Several variations of these conditions were used to achieve this. The anaerobic digestion process was conducted over two months at  $30.42\text{ }^{\circ}\text{C} \pm 0.05\text{ }^{\circ}\text{C}$ , and the biogas production rate was measured every two days. The 1:1 ratio showed better results compared to the 2:1, because it allows the bacteria to achieve metabolic balance. The highest cumulative biogas production (27.91 mL/g TS) was generated when the sago waste underwent milling ( $\pm 1\text{ mm}$ ), pretreatment with 4% NaOH g/g TS, and treatment with microbial consortium 5% v/v at a 1:1 ratio of solid sago waste to the rumen.

**Keywords:** anaerobic digestion; biogas; pretreatment; solid-state anaerobic digestion method; solid sago waste



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## 1. Introduction

Renewable energy sources, e.g., biogas, are alternatives to fossil fuels and are used to overcome the energy crisis [1,2]. Biogas can be obtained from various organic wastes, such as animal wastes (manures), various byproducts from human activities (sewage sludge, wet market waste, and municipal solid waste), and plants (agricultural waste), through anaerobic digestion in which the microorganisms degrade the organic matter in four main steps hydrolysis, acidogenesis, acetogenesis, and methanogenesis. The product gas is then used as a renewable energy source [1–3]. Typically, biogas consists of methane ( $\text{CH}_4$ , 55–70%) and carbon dioxide ( $\text{CO}_2$ , 30–45%) as well as some impurities, such as  $\text{H}_2\text{S}$  (0–0.5%),  $\text{NH}_3$  (0–0.05%), water vapor (1–5%), and  $\text{N}_2$  (0–5%) [4]. Biogas can be used to produce heat and electricity or as a fuel for transportation after being subjected to a special treatment such as the process of removing impurities and the process of increasing heating value, causing high-quality biomethane and resulting in a significant reduction in greenhouse gas emissions and other pollutants and reducing the dependence on fossil fuels [1,5,6].

Solid sago waste is a readily available organic material that contains enough lignocellulose as raw materials in biogas production. Co-digestion of different types of biomasses, such as cattle dung with solid sago waste, offers great potential to increase the volume of biogas. Co-digestion has many advantages, such as a C/N ratio optimization and eliminates the accumulation of toxic compounds for microorganisms [6,7]. Additionally, pretreatment can increase biogas productivity by removing lignin and hemicellulose, which are difficult for microorganisms to digest. Several types of pretreatments, including physical; chemical; and biological pretreatments, can be used in biogas production [8]. Grinding is the most common physical pretreatment [9]. Chemical pretreatments include alkali [10]



## Article

# The Combined Effect of Alcohols and *Calophyllum inophyllum* Biodiesel Using Response Surface Methodology Optimization

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**Abstract:** In this experimental study, the performance of the diesel engine was analyzed for biodiesel derived from *Calophyllum inophyllum*. The impact of the addition of additives such as *N*-octanol and *N*-butanol with *Calophyllum inophyllum* biodiesel has been assessed. Impact of the application of hybrid *N*-octanol and *N*-butanol with biodiesel on emission profile used for the engine performance has also been demonstrated. Response surface analysis of alcohol additives-biodiesel blend was performed separately in this study for the engine efficiency and emission profile. A combination of *N*-octanol and *N*-butanol presented the highest brake thermal efficiency (BTE) and lowest carbon monoxide (CO) emission among the ternary blends of octanol. *N*-butanol-biodiesel blend presented the lowest hydrocarbon (HC) emission among the blends of *N*-butanol. *N*-octanol with 5 and 10% addition with biodiesel showed the lowest HC emissions among the blends of octanol. The response surface methodology (RSM) optimization revealed that the optimized thermal efficiency and emission were obtained at full load and minimum load, respectively. The addition of *N*-octanol hindered the emission at all loads, while *N*-butanol reduced it at higher loads. A strong correlation between the load and alcohol additives on the engine performance and emission profile has been obtained using the RSM optimization approach. The R-squared value obtained from the RSM was 0.92 and emission profile has been characterized.


**Keywords:** engine; biodiesel; alcohols; efficiency; emission; properties

## 1. Introduction

Diesel engines have become the primary transport source, in this technologically advanced era. Diesel fuel is used in a wide range of applications, from industry to automobiles. Diesel fuel is well known for improving engine performance and reducing emissions in vehicles. However, this valuable resource has been exhausted due to the rapid and excessive use of diesel and other fossil fuels. Additionally, the heavy use of fossil fuels increased greenhouse gas (GHG) emissions that consequently increased the global temperature contributing to the depletion of the ozone layer, thereby allowing UV rays to penetrate the planet. In addition, due to the emissions of various noxious pollutants such as sulfur oxides (SO<sub>x</sub>), hydrocarbons (HC), carbon mono-oxides (CO), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM) and smoke, excessive use of fossil fuels has caused biohazards [1,2]. In addition, excessive use of fossil fuel has increased crude oil demand and market price on the global market. In addition, strict government regulation

## Article

# Ferric Oxide-Containing Waterworks Sludge Reduces Emissions of Hydrogen Sulfide in Biogas Plants and the Needs for Virgin Chemicals

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**Abstract:** Ferric oxide-containing waterworks sludge can be used to reduce the formation of hydrogen sulfide during anaerobic digestion. The ferric compound is reduced biochemically in the digester and forms insoluble pyrite in digester sludge. Virgin ferric chloride is often used to solve the hydrogen sulfide problem. Since 2013, Sydvatten AB has supplied a growing number of digestion plants in Sweden with ferric-containing dewatered waterworks sludge derived from the drinking water treatment plant Ringsjöverket to limit the formation of hydrogen sulfide. At the waterworks, ferric chloride is added to enhance the coagulation of organic matter from the source water. The sludge formed in this process is dewatered and landfilled, but also recycled in biogas production in order to decrease the hydrogen sulfide concentration. In this study, the use of sludge for hydrogen sulfide removal in digesters was technically and economically evaluated via case studies from 13 full-scale digesters in Sweden. Compared with the use of fresh ferric chloride, the operational costs are reduced by up to 50% by using sludge. The quality of the sludge is high and its content in metals is low or very low, especially when compared with the requirements of different certification standards for biosolid reuse applied in Sweden. The addition of waterworks sludge containing iron to a digester for the removal of dissolved hydrogen sulfide is a technically and economically good alternative when producing biogas. It is also one step closer to a circular economy, as replacing the use of virgin chemicals with the by-product waterworks sludge saves energy and materials and reduces the carbon footprint of the waterworks.

**Keywords:** biogas digestion; hydrogen sulfide; ferric oxide; waterworks sludge



## 1. Introduction

Biogas production is gaining increasing attention as a source for replacing fossil-based fuels with renewable fuels in society. Biogas is typically produced in anaerobic digestion plants (AD), where different substrates rich in organics are digested by methanogenic bacteria. Most substrates also contain sulfur, which in anaerobic environments can be microbiologically reduced to hydrogen sulfide, which negatively affects the metabolic activity of the methanogens and eventually poisons the digester. Additionally, hydrogen sulfide is a technical issue in plants and downstream when biogas is used, since hydrogen sulfide corrodes pipes, generators and other equipment. It is also a health hazard, being toxic to humans. Improving the quality and quantity of biogas usually requires pre-treatment to maximize methane yields and/or post-treatment to remove hydrogen sulfide. This requires considerable energy consumption and higher costs; hence there are needs for better and more efficient measures to control hydrogen sulfide production [1].

One way to remove hydrogen sulfide as a gas is to add ferric salts to the substrate or to the digester. Ferric salts can be reduced to ferrous iron and form pyrite ( $\text{FeS}_2$ ) as a precipitate. Often, ferric chloride solution is dosed into the reactor to achieve this removal effect on hydrogen sulfide. However, the addition of virgin ferric salts has an operational

## Article

# Changes in Reserve Mobilization Caused by Salinity Could Interfere in the Initial Growth of *Jatropha curcas*

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**Abstract:** Salinity in soil can affect *Jatropha* seedling metabolism, interfering with plant establishment. In this study, the effect of salinity on the mobilization of reserves during the development of *Jatropha* seedlings was tested. Two genotypes of *Jatropha* were used and three concentrations of NaCl were applied between the 4th and 8th days after germination. The effects of salinity on seedling growth, in terms of fresh and dry phytomass, ionic partition, and sugar quantification, starch, proteins, amino acids, and lipids were evaluated in cotyledon leaves, hypocotyls, and roots. There was an increase in the content of all classes of macromolecules analyzed in at least one of the organs. It is hypothesized that the hypocotyls acted as an accumulating organ of Na<sup>+</sup>. The accumulations of amino acids and protein in roots suggest that metabolic responses occurred in response to the ionic and osmotic effects of NaCl, although this accumulation did not appear to prevent biomass losses in seedlings. Furthermore, the findings of this study demonstrate that salinity inhibits the mobilization of lipids and carbon stocks from cotyledon leaves to the rest of the plant, and together with the synthesis of proteins and amino acids that occurred primarily in roots, contributed to response of these plants to salinity.

**Keywords:** germination; seedling metabolism; partition of macromolecules; salinity

## 1. Introduction

Excess soil salts are among the main problems faced by world agriculture [1,2]. In Brazil, and especially in its semi-arid northeast, soil salinization becomes even more serious due to its association with the low precipitation and the high rate of evapotranspiration which are characteristic of this region [3]. Thus, salinized areas are no longer profitable for farmers and are consequently abandoned [4].

One potential alternative for the reuse of such areas is the selection and introduction of species tolerant to adverse environmental conditions [5]. In this context, perennial oleaginous plants, such as *Jatropha curcas* L., are compatible with the edaphoclimatic conditions of the Brazilian semiarid region due to their moderate resistance to drought and salinity [6]. In addition, this species has great economic importance, due to its medicinal and ornamental use and for biodiesel production [7].

Excess salts compromise the physiological and biochemical functions of plants, causing osmotic stress which results in disturbances of water conductance. They also cause changes in the absorption and utilization of essential nutrients and intensify the ionic