LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : PROSIDING

Judul Karya Ilmiah	:	Significant energy use analysis and energy conservation on Diponegoro University		
Jumlah Penulis	:	6 Orang (**Jaka Windarta**, AFH Mukhammad, Denis, Y Hartadi, MK Aldianto, C Radityatama)		
Status Pengusul	:	Penulis ke – 1		
Identitas Prosiding	:	a. Judul Prosiding	:	2nd International Conference on Environment, Sustainability Issues, and Community Development, INCRID 2020
		b. ISBN/ISSN	:	17551307
		c. Thn Terbit, Tempat Pelaks.	:	2020, Semarang, Indonesia
		d. Penerbit/Organiser	:	IOP Publishing Ltd
		e. Alamat Repository/Web	:	https://iopscience.iop.org/article/10.1088/1755-1315/623/1/012060
		Alamat Artikel	:	https://iopscience.iop.org/article/10.1088/1755-1315/623/1/012060/pdf
		f. Terindeks di (jika ada)	:	Scopus H Index : 18 SJR Index : 0.175

Kategori Publikasi Makalah (beri ✓pada kategori yang tepat) :
- [√] *Prosiding* Forum Ilmiah Internasional
- [ ] *Prosiding* Forum Ilmiah Nasional

Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Reviewer		Nilai Rata-rata
	Reviewer I	Reviewer II	
a. Kelengkapan unsur isi prosiding (10%)	2,5	2,5	2,5
b. Ruang lingkup dan kedalaman pembahasan (30%)	7,5	7	7,25
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,5	7,5	7,5
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	8	8	8
Total = (100%)	**25,5**	**25**	**25,25**
Nilai Pengusul = (60% × 25,25) = 15,15			

Semarang,

Reviewer 2

Mochammad Facta, S.T., M.T., Ph.D.
NIP. 197106161999031003
Unit : Teknik Elektro FT UNDIP

Reviewer 1

Dr. Wahyudi, ST, MT
NIP. 196906121994031001
Unit : Teknik Elektro FT UNDIP

LEMBAR
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		e. Alamat Repository/Web	:	https://iopscience.iop.org/article/10.1088/1755-1315/623/1/012060
		Alamat Artikel	:	https://iopscience.iop.org/article/10.1088/1755-1315/623/1/012060/pdf
		f. Terindeks di (jika ada)	:	Scopus H Index : 18 SJR Index : 0.175

Kategori Publikasi Makalah (beri ✓pada kategori yang tepat) : [√] *Prosiding* Forum Ilmiah Internasional
[ ] *Prosiding* Forum Ilmiah Nasional

Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Maksimal Prosiding		Nilai Akhir Yang Diperoleh
	Internasional [30]	Nasional [ ]	
a. Kelengkapan unsur isi prosiding (10%)	3,00		2,5
b. Ruang lingkup dan kedalaman pembahasan (30%)	9,00		7,5
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	9,00		7,5
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	9,00		8
Total = (100%)	**30,00**		**25,5**
Nilai Pengusul = (60% × 25,5) = 15,3			

Catatan Penilaian Paper oleh Reviewer :

1. **<u>Kesesuaian dan kelengkapan unsur isi paper:</u>**
   Unsur paper : Pendahuluan, metode, hasil, kesimpulan dan daftar pustaka. Semua pustaka disitasi. Struktur baik. Gambar 1 tidak disitasi. Gambar 3 salah sitasi.
2. **<u>Ruang lingkup dan kedalaman pembahasan:</u>**
   Tidak menjelaskan penelitian sebelumnya. Tidak ada pustaka dari jurnal atau seminar yang disebutkan dalam pembahasan.
3. **<u>Kecukupan dan kemutakhiran data/informasi dan metodologi:</u>**
   Kemutakhiran data kurang. Dari 10 pustaka hanya 2 yang terbit kurang dari 10 tahun dan tidak ada yang berasal dari jurnal atau seminar.
4. **<u>Kelengkapan unsur dan kualitas terbitan:</u>**
   Kualitas terbitan bagus : tampilan jurnal, editor, panduan penulis dan terindeks Scopus.

Semarang,

Reviewer 1

Dr. Wahyudi, ST, MT
NIP. 196906121994031001
Unit : Teknik Elektro FT UNDIP

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		f. Terindeks di (jika ada)	:	Scopus H Index : 18 SJR Index : 0.175

Kategori Publikasi Makalah (beri ✓pada kategori yang tepat) : [√] *Prosiding* Forum Ilmiah Internasional
[ ] *Prosiding* Forum Ilmiah Nasional

Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Maksimal Prosiding		Nilai Akhir Yang Diperoleh
	Internasional [30]	Nasional [ ]	
a. Kelengkapan unsur isi prosiding (10%)	3,00		2,5
b. Ruang lingkup dan kedalaman pembahasan (30%)	9,00		7
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	9,00		7,5
d. Kelengkapan unsur dan kualitas terbitan/prosiding(30%)	9,00		8
Total = (100%)	**30,00**		**25**
Nilai Pengusul = (60% ×25) = 15			

Catatan Penilaian Paper oleh Reviewer :

1. **<u>Kesesuaian dan kelengkapan unsur isi paper:</u>**
   Makalah telah ditulis sesuai dengan format dan kaidah ilmu yang berlaku secara umum untuk penulisan makalah prosiding internasional. Makalah ditulis secara lengkap dan sistematis yang mencangkup abstract, introduction, dan reference.
2. **<u>Ruang lingkup dan kedalaman pembahasan:</u>**
   Ruang lingkup dan kedalaman pembahasan sudah sesuai, kedalaman analisa sangat baik, tinjauan pendekatan teori,analisa dan kesimpulan jelas, tahapan dan susunan penulisan secara cukup bagus. Pembahasan paper masih dalam bidang kepakaran penulis yakni sesuai dengan bidang penulis yakni upaya cara-cara konservasi energilistrik dengan mempertimbangkan pemakaian peralatan dan lampu listrik dan terukur dengan alat pengukur energi listrik digedung bangunan.
3. **<u>Kecukupan dan kemutakhiran data/informasi dan metodologi:</u>**
   Data dan informasi disajikan dengan sangat baik dengan merujuk 10 referensi. Jumlah dan tahun terbit paper-paper yang dijadikan sebagai acuan atau referensi pada paper ini cukup lengkap, demikian pula data dan informasi yang disajikan berdasar paper yang diterbitkan dalam referensi terkait dengan konservasi energi khususnya pemakaian lampu listrik dan peralatan listrik lainnya pada gedung bangunan.
4. **<u>Kelengkapan unsur dan kualitas terbitan:</u>**
   2nd International Conference on Environment, Sustainability Issues, and Community Development, INCRID 2020, ISSN : 17551307,2020, https://iopscience.iop.org/article/10.1088/1755-1315/623/1/012060/pdf, Terindex Scopus. Prosiding ini diterbitkan oleh publisher IoP conference series yang rutin menerbitkan konferensi internasional yang telah dikenal dan tersitasi di SCOPUS dengan setiap edisinya lengkap dan memiliki kualitas cetakan yang baik. Ukuran dan font tulisan dapat terbaca dengan cukup jelas.

Semarang,

Reviewer 2

Mochammad Facta, S.T., M.T., Ph.D.
NIP. 197106161999031003
Unit : Teknik Elektro FT UNDIP

International Conference on
Environment, Sustainability Issues,
and Community Development (INCRID)

CERTIFICATE

OF APPRECIATION

Number : 1100/UN7.P/HK/2020

THIS CERTIFICATE IS PRESENT TO

Dr. Ir. Jaka Windarta, M.T.

HAS PARTICIPATED AS

PRESENTER

"Recent Updates and Challenges on Environmental Technology, Sciences, Education and Innovations"

SEMARANG, 21 OCTOBER 2020

Dean

Ir. M. Agung Wibowo, M.M., M.Sc., PhD

NIP. 196702081994031005

Chair of Organizing Committee

Dr. Haryono Setyo Huboyo, S.T., M.T

NIP. 197402141999031002

Document details

IOP Conference Series: Earth and Environmental Science
Volume 623, Issue 1, 8 January 2021, Article number 012060
2nd International Conference on Environment, Sustainability Issues, and Community Development, INCRID 2020; Semarang, Virtual; Indonesia; 21 October 2020 through ; Code 166804

Significant energy use analysis and energy conservation on Diponegoro University

(Conference Paper) (Open Access)

Windarta, J.[a,b], Denis[a], Mukhammad, A.F.H.[c], Hartadi, Y.[a], Aldianto, M.K.[b], Radityatama, C.[b]

[a]Master of Energy, School of Postgraduate Studies, Universitas Diponegoro, Semarang, Indonesia
[b]Department of Electrical Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia
[c]Department of Vocational School, Vocational School, Universitas Diponegoro, Semarang, Indonesia

Abstract

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In the current era of technology and information advancements, consumer growth and electrical energy are certainly getting more significant over time. Therefore, Energy Conservation can be carried out to find detailed information on energy usage. How much should be paid in using that energy, Biggest potential user, and ultimately this Conservation energy will show recommendation on Operational Equipment, even the processes. According to the Regulation No. 13 of 2012, concerning an infrastructure that requires large-scale energy use, conservation energy needs to be done as the will for maintaining the balance of energy using further on maintaining Eco saving energy for further generation come as well as Psychology Faculty Universitas Diponegoro from 2016 to 2019 have a specific large number of Energy consumer as education infrastructure that included from 13 Faculty and 5 unit operation. From that faculty, there is spread more inside each faculty called Unit. Overall, In this case from 13 Faculty and 5 Unit, we analyze the detailed recommendation for the Psychology Faculty of Diponegoro University as the newest building infrastructure and Non-Exact type Educational Departement such as Potential energy user of Equipment and Lightning. © 2021 IOP Conference Series: Earth and Environmental Science

SciVal Topic Prominence

Topic: Household Energy | Savings Behavior | Smart Meters

Prominence percentile: 99.358

Indexed keywords

Engineering controlled terms: Energy conservation | Potential energy

Engineering uncontrolled terms: Balance of energies | Electrical energy | Energy consumer | Energy needs | Energy usage | Operational equipment | Potential users | Saving energy

Engineering main heading: Sustainable development

ISSN: 17551307
Source Type: Conference Proceeding
Original language: English
DOI: 10.1088/1755-1315/623/1/012060
Document Type: Conference Paper
Publisher: IOP Publishing Ltd

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(Semarang: Universitas Diponegoro)

Windarta, J.; Master of Energy, School of Postgraduate Studies, Universitas Diponegoro, Semarang, Indonesia ;
email:jakawindarta@lecturer.undip.ac.id

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Last updated on 02 March, 2021 • Updated monthly

CiteScore rank 2019

Category	Rank	Percentile
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Earth and Planetary Sciences General Earth and Planetary	#164/187	12th

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"Recent Updates and Challenges on Environmental Technology, Sciences, Education, and Innovations"

21st October 2020
Virtual Conference
Semarang, Indonesia

SCHEDULE & PAYMENT

REGISTRATION

-Topics-

A. Environment, Health, & Safety

– Environment, health, and safety system

– Environmental modelling and computation

– Risk analysis

B. Environmental Science, Technology, and Education

– Waste management and treatment

– Water and wastewater engineering

Preface

After being successfully held in 2019, the 2nd International Conference on Environment, Sustainability Issues and Community Development (INCRID) 2020 was held at a full teleconference in a virtual environment on October 21st, 2020, by "ZOOM". The reason is, active cases of COVID-19 in Indonesia are still increasing, and it is not sure whether October 2020 has returned to normal. Besides, we want this conference to be held regularly. INCRID 2020 is hoped to bring innovative ideas from academics and industrial experts in the field of environment. The conference's primary goal is to promote research and developmental activities in environmental sciences and promote scientific information interchange between researchers, developers, engineers, students, and practitioners working all around the world. The conference was held every year to make it an enabling platform for people to share views and experiences in an environmental context. The conference featured five keynotes (40 minutes each, including Q&A). The plenary session was divided into 2 sessions, which 2 of the 5 speakers gave their talk in the first session and the last 3 in the second session. The speakers shared their slides (through share screen mode) by themselves. However, the committee helped them to share the slides whenever the speakers were getting trouble. Discussion and Q&A in the plenary session were included in the time that was given to them. The moderator gave a sign if the time was over through Zoom's personal chat. Also, we passed 10 minutes for each presentation through the zoom's breakout room. We divided the parallel session into 8 rooms, which can be attended by 10 people (minimum) for each room. Apart from using the zoom platform, We also try to use any other system such as youtube and Instagram for plenary session live streaming and google forms for ensuring the participant attends the conference from beginning to the end. There were around 110 participants, 5 keynotes speakers, 10 moderators (2 in keynote session and 8 in parallel session), 8 co-host, and 48 committees. Participants can share their thoughts remotely (from their home).

We invited some international participants as asked speakers in parallel sessions, including Uganda, Egypt, Japan, Malay, Aussie, and other countries. We were incredibly honored to have invited Dr. Haryono Setiyo Huboyo, S.T., M.T, from Diponegoro University, Indonesia, to serve as our General Conference Chair. The rest of the committee was composed of Indonesia, Italy, Australia, Japan and other countries. In the keynote presentations part, we invited Dr. Swaib Semiyaga from Makerere University (Uganda), Mario Rosario Guarracino, Ph. D from National Research of Council of Italy (Italy), Prof. Dr. Ir. Ambariyanto, M.Sc. from Diponegoro University (Indonesia), Prof. Toru Matsumoto from University of Kitakyushu (Japan), and Dr. Mai Sayed Fouad from Fayoum University (Egypt). The conference provided a forum for discussing environmental topics and, in particular, for promoting the exchange of new ideas and the presentation of the latest developments in this field. This conference also provided an ideal environment for developing new collaborations and meeting experts on the fundamentals, applications, and products of the mentioned fields.

We are glad to share with you that we received lots of submissions from the conference, and we selected a bunch of high-quality papers and compiled them into the proceedings after rigorously reviewed them. These papers feature the following topics: environment, health, and safety, environmental science, technology, and education, green infrastructure, and energy conservation and efficiency. All the papers have been through rigorous review and process to meet the international publication standard's requirements. Lastly, we would like to express our sincere

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Accepted papers received: 02 December 2020

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A M Hamdani, A Suprapti and R S Rukayah

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A Syakur, H Afrisal, A Jatmika and Y H Saragi

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R A Tanjung, PP A W Yusariarta and M Wulandari

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Characteristics of *Kemiri Sunan* (*reutalis trisperma* (blanco) airy shaw) biodiesel processed by a one stage transesterification process

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Significant energy use analysis and energy conservation on Diponegoro University

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Abstract. In the current era of technology and information advancements, consumer growth and electrical energy are certainly getting more significant over time. Therefore, Energy Conservation can be carried out to find detailed information on energy usage. How much should be paid in using that energy, Biggest potential user, and ultimately this Conservation energy will show recommendation on Operational Equipment, even the processes. According to the Regulation No. 13 of 2012, concerning an infrastructure that requires large-scale energy use, conservation energy needs to be done as the will for maintaining the balance of energy using further on maintaining Eco saving energy for further generation come as well as Psychology Faculty Universitas Diponegoro from 2016 to 2019 have a specific large number of Energy consumer as education infrastructure that included from 13 Faculty and 5 unit operation. From that faculty, there is spread more inside each faculty called Unit. Overall, In this case from 13 Faculty and 5 Unit, we analyze the detailed recommendation for the Psychology Faculty of Diponegoro University as the newest building infrastructure and Non-Exact type Educational Departement such as Potential energy user of Equipment and Lightning.

1. Introduction

Energy is the crucial things that could help our life activities more accessible, but in overcome using energy that over from regular using will connect with ISO 5001 is un-efficient, Energy Conservation on Diponegoro University which contain 13 Faculty and 5 unit field survey proofing that over from Secondary data year 2016 to 2019 until now 2020, For instance, RSND is the highest payment bill to PLN from 2016 to 2019 by the secondary data [1,2]. In this case, according to *Peraturan Menteri ESDM No. 14, 2012 Article 10* periodically, conservation energy on any infrastructure in each environment or organization infrastructure should be done[3-6]. From 13 Faculty and 5 unit Audit, we take a study case at Psychology Faculty. Hedaya Wafid already did previous research with the title *Analysis of electrical energy users in UNDIP Tembalang campus using WEB-based software* [7]. This research purpose is not using energy-saving and recommendations from energy conservation that have been analyzed based on secondary data [8]. According to our research, we analyze further the recommendation and energy

Simulation sediment transport in development location of a diesel power plant using Computational Fluid Dynamic (CFD) methods

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Abstract. Research about Sediment Transport is important for the sustainability of coastal buildings. The infrastructure construction of the Halmahera Diesel Power Plant (PLTD) in the coastal area requires water supply as a cooling system. The supply of cooling water can be reduced because of erosion or sedimentation. This study uses CFD modelling of ANSYS FLUENT applications with variations in mass flow rates. The Eulerian-Lagrangian approach is used to predict the rate of erosion and accretion that occur around the place of Halmahera. Methods of Particle Size Distribution (PSD) numerical simulation is uniform. The simulation process results consist of particle mass, erosion, and accretion rate in the seabed. Variations in mass flow rates of 0.05 kg/s, 0.1 kg/s, 0.15 kg/s, 0.2 kg/s, 0.25 kg/s obtained the erosion rate respectively 5.425 x 10^{-7} mm/year, 1.085 x 10^{-6} mm/year, 1.626 x 10^{-6} mm/year, 2.170 x 10^{-6} mm/year, 2.712 x 10^{-6} mm/year. The result of the accretion rate obtained from the variation in mass flow rates is 301.43 mm/year, 602.87 mm/year, 904.30 mm/year, 1205.50 mm/year, 1507.77 mm/year. From this research. The result of simulation to be important to predict the rate of sediment transport for consideration in the development location of construction Halmahera PLTD.

1. Introduction

A natural process that often happens in the coastal area will have resulted in sediment transport. These conditions will result in accretion and erosion. Sedimentation or erosion across the coastline will have impacted the form of coastal buildings (ex: pier, jetty, wave breaker, groin, artificial sea wall, etc.). Halmahera East Ternate island is a specified location for Diesel Power Plant Construction (PLTD). The diesel power plant is usually used for fulfilling the electric in low capacity, new isolated place, village, and industrial needs. The diesel power plant needs a huge water consumption for its cooling system. The lack of water needs for cooling system because of sediment transport, will prevent diesel power plant to work properly [1]. The research uses the data from the temporal change of shoreline that needs expensive cost and longtime research so that simulation needed to be efficient processes [2].

Research about sediment transport conducted by Javaherci and Aliseda (2017) used Discrete Random Walk (DRW) method on simulation to obtain sediment transport rate which marine hydrokinetic turbine

Cultivation process of microalgae using wastewater for biodiesel production and wastewater treatment: a review

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Abstract. Combining microalgae cultivation with nutrient removal is a promising technique as it enables renewable energy generation with the additional potential removal of wastewater contaminants in a single process. Performance and total yield of this process are still below the standard for industrialization. Thus, optimization is needed to reach the feasibility and actualize the concept. Cultivation conditions and reactor design play essential roles in the application and feasibility of this process. Both aspects have been developed through the years to enable the industrial application of this concept. Cultivation conditions are usually categorized into trophic conditions in which each situation has its specific function and target of removal. These conditions, however, are also applied in various reactor systems. Closed photobioreactor and open pond are two central systems for the reactor. Two of the most applied reactor models in wastewater are reviewed here to create a broad picture of the algae cultivation process by emphasizing biomass production and considering different aspects.

1. Introduction

Microalgae culture is considered as the future generation of biofuel source with many additional advantages. Among the advantages, nutrient removal and carbon sequestration are on top of the priority list; hence, this technology's benefit in overcoming environmental issues is very favorable [1-3]. Lately, more significant scale applications with numerous technologies vary the possibility of applying many wastewater sources and characteristics.

The microalgae cultivation process with a specific bioreactor design shows essential roles in the application and feasibility of coupling biomass generation with a wastewater treatment system [4]. Among factors that determine the coupling feasibility, light penetration and agitation process are commonly mentioned in this system. Both of operational parameters are mostly affected by the design of the reactor in which the generation of algae biomass is conducted [5]. The agitation and light penetration are essential to ensure high biomass productivity and wastewater recovery [4,6]. Similarly, the *trophic* condition must count as the first consideration since algae can cope with many carbon and energy, including the one in the system of wastewater treatments [7].

Nonetheless, many wastewater applications as sources of nutrients for microalgal growth failed to reach high biomass yield. Some of the applications focused on the strains and co-cultivation microorganisms while the operational conditions were less considered. Failure to identify and construct

Environmental dimension of pandemic COVID-19: case studies of Indonesia

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Abstract. Pandemic COVID-19 adversely affects all aspects of life. Industries and transportation reduce its activities, causing a decline in demand for logistics significantly. In Indonesia, 2.8 people predicted will be laid off, 2.9-5.2 million people lose a job, unemployment will increase to 7.5%, poverty increases to 27.5 million people (10.2%), economic growth minus 5.32%. On the other side, the air quality index decreased from 155 at the end of March to 69 in April. The indicator of air quality (PM 2.5) decreased from 63.4 ug/m^3 to be 20.8 ug/m^3. However, there has been increased in the amount of medical waste and energy consumption. This research aims to identify the impacts of pandemic COVID-19 on the environment and the commitment of the government to deal with climate change-related to SDGs. The result of research shows that the new normal increases the number of people infected by COVID-19 significantly. The government's commitment to dealing with climate change is decreased due to the policy to refocus and reallocate the budget to deal with pandemic COVID-19. It is required to balance the health aspect and economic aspect for the nation's sustainability and people's lives.

1. Introduction

1.1. Research background

COVID-19 outbreak has been the momentum to show the government's ability to handle emergency situations and examine our adaptability and resilience in dealing with uncertainties. As per today (16th of September) 29,155,581 confirmed cases and 926,544 deaths worldwide per today [1]. The government of Indonesia is firstly showing ignorance in the occurrence of this pandemic. All the sudden shift comes after our President having a call with the Director of WHO [2]. There was two months' gap between international level consideration of COVID-19 as a public health emergency with national level, which started one on 30th of January. Yet, Indonesia had just started on 2nd of March, 2020.

After two months of lockdown-like policy called large scale social restriction (*PSBB*) being implemented, when economic sector started to collapse, national government choose to promote a shift towards new normal era through Decree of the Minister of Health *HK.01.07/MENKES/328/2020* concerning Guidelines for the Prevention and Control of COVID-19 in Office and Industrial Workplaces. It was decided that people are allowed to their normal activities by following the health protocol. For the economic recovery plan, the Indonesian government had ratified Government

Numerical simulation of detailed airflow distribution in newly developed photosynthesis chamber

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Abstract. Predictive numerical simulation of airflow uniformity in canopy plants could provide a suitable environment for plant growth. A numerical investigation of airflow in a photosynthesis chamber was conducted using the Computational Fluid Dynamics (CFD) model. This research-validated the numerical model with measurements performed in a bare bottom open chamber. The chamber has bottom openings with three exhaust fans on the roof. After model validation, airflow patterns and their uniformity were evaluated in different fan arrangements and doubled air volume rates. The obtained results showed that a more uniform airflow distribution was observed with increasing the fan's air volume rate (0.0187, 0.0172, and 0.0177 m^3s^{-1}), particularly fan in the middle position and diagonally position inside the plant with coefficients of variation of 14.36%, 9.3% and 10%, respectively. Moreover, increasing the fan's air volume rate and moving the fan positions to the middle and diagonally can significantly help produce uniform air velocity distribution inside the plant.

1. Introduction

The response of net photosynthesis to air velocity has become vital in increasing and maintaining airflow uniformity in the plant canopy. Many researchers have conducted air velocity studies in the plant canopy to investigate its influence on plants. For example, Shibuya et al. (2006) experimentally clarified that upward and downward airflows enhanced the CO_2 exchange rate of the canopy and dry masses of the seedlings from 1.4–1.5 and 1.2–1.3 times, respectively, compared with a conventional horizontal airflow [1]. Okayama et al. (2008) reported (that fans set on both sides of the space and opposed fans not set coaxially) could provide more uniform airflow distribution than the conventional airflow pattern (fans set on one side of the room) [2]. It also enhanced the net photosynthetic rate more than that in the traditional airflow pattern with the same energy input. Furukawa (1975) showed that changing the air temperature did not significantly affect airflow rate efficiency on photosynthesis but increasing the light intensity enhanced it significantly [3].

Primary data on adequate air circulation to enhance plant growth in a closed plant culture system (chamber) were obtained by investigating the effects of the current airspeed ranging from 0.01–1.0 ms^{-1}. Researchers also found that the plant canopy's net photosynthetic rate doubled with increased air