



**5th International Conference on Energy, Environment,
Epidemiology and Information System (5th ICENIS) 2020**

Organized by

**School of Postgraduate Studies
Universitas Diponegoro**

12-13th August 2020

Preface

The 5th International Conference on Energy, Environment, Epidemiology and Information System 2020 (5th ICEN IS 2020) has been organized by the School of Postgraduate Studies, Universitas Diponegoro, Indonesia with the support by World Class University (WCU) Program. The conference was held on August 12th-13th 2020 in Semarang, Indonesia by using Online Conference System. The aim of the conference was to distribute research outcomes on multidisciplinary research area on energy, environment, health and epidemiology and information system.

The 5th ICENIS 2020 have presented 10(ten) international honorable keynote speakers from representative institutions and continents: i) Prof. Elco van Burg, Vrije University Amsterdam, The Netherlands; ii) Prof Peter Gell, Federation University, Australia., iii) Prof. Jerry Miller, Western Carolina University, USA; iv) Prof. Shabbir Gheewalla, Joint Graduate School of Energy and Environment (JGSEE), Kingmookut University, Thailand; v) Assoc. Prof. Zainul Zakaria, Chemical Engineering Department, UTM Malaysia; (vi) Dr Yurdi Yasmi; Regional representative of IIRRI for Southeast Asia, Cambodia; (vii) Dr Nuki Agya Utama, Executive Director of Asean Energy research; (viii) Patrick van Schijndel, TU Delft, The Netherlands, (ix) Barokah Sri Utami, Former President Director of PT Phapros, Indonesia, and (x) Dr Liew Kian heng from Strategics Singapore. Pursuing the international network of researchers and industrial applications, this event also has been attended by overseas colleagues to share their best research works as well as local academia and practitioners. Over 320 representatives from various institutions participated in this event, involving more than 340 abstracts submitted. After a rigorous selection process, the Scientific & Editorial Board of 5th ICENIS 2020 made selection of 300 articles to be published in E3S Web of Conferences, an open-access proceedings in environment, energy and earth sciences, managed by EDP Sciences, and indexed on Scopus, Scimago, Conference Proceedings Citation Index-Science (CPCI-S) of Clarivate Analytics's Web of Science, DOAJ (Directory of Open Access Journals). The Proceedings of 5th ICENIS 2020 consists of selected articles from Kazakhstan, Libya, Netherlands, Thailand, Malaysia. The published papers have passed all necessary improvement requirements in accordance to the Web of Conferences standard, reviewer's comments, SI, similarity tests by Turnitin program.

We would like to express our gratitude to the official committee, scientific & editorial boards, organizing partners. A very special thanks to Universitas Diponegoro for financially supporting this conference especially for financing indexing of proceeding in E3S. Finally, we would like to briefly acknowledge all presenters and attendees for their efforts sharing the beautiful ideas and useful research outcomes to inspire further research and collaborations. Although, this time the conference has been successfully conducted via webinar, but the number of participants showed a great increases and we do hope that this also will be the same for the coming 6th ICENIS 2021.

See you again in the next year conference 5th ICENIS 2021

The chairman

Prof. Hadiyanto

SCIENTIFIC and EDITORIAL BOARD

1. Prof. Tri Retnaningsih Soeprbowati (Graduate Program of Environmental Sciences, Universitas Diponegoro, Indonesia)
2. Prof. Sudahrto P Hadi (Graduate Program of Environmental Sciences, Universitas Diponegoro, Indonesia)
3. Prof Purwanto (Chemical Engineering Department , Universitas Diponegoro, Indonesia)
4. Prof. Henk Heijnis, (ANSTO Australia)
5. Dr Zainul Zakaria (UTM Malaysia)
6. Prof. Shabbir Gheewala (JGSEE, Thailand)
7. Prof. Hadiyanto (School of Postgraduate Studies, Universitas Diponegoro, Indonesia)
8. Prof. Peter Gell (Federation University, Australia)
9. Prof. Elco van Burg (Vrij University, The Netherlands)
10. Dr Thomas Putranto Triadi (Faculty of Engineering, Universitas Diponegoro, Indonesia)
11. Dr Hartuti Purnaweni (Graduate Program of Environmental Sciences, Universitas Diponegoro, Indonesia)
12. Dr Sudarno (Graduate Program of Environmental Sciences, Universitas Diponegoro, Indonesia)
13. Dr Budi Warsito (Graduate Program of Information System, Universitas Diponegoro, Indonesia)
14. Dr Suryono (Graduate Program of Information System, Universitas Diponegoro, Indonesia)
15. Dr Maryono (Graduate Program of Environmental Science, Universitas Diponegoro, Indonesia)

The School Of Postgraduate Studies,
Diponegoro University

5th
**ICENIS
2020**



Online
International
Conference

*Emphasizing Environment And Human
Security Towards Global Sustainable
Development Goals (SDGs) 2030*



Topic

Energy

- Energy management and policy
- Energy planning and Education
- Energy conservation and efficiency
- Energy conversion technology
- Renewable energy
- Nonrenewable energy / Fossil energy
- Culture and Environmental Development in Coastal Community

Environment

- Environmental Conservation
- Environmental Policy, Planning and Education
- Environmental Technology
- Environmental Health and Toxicology
- Environmental Epidemiology
- Pollution Control
- Waste Management
- Green Infrastructure and Resilience

Epidemiology

- Epidemiology related to disease and health event prevention and control
- Managerial epidemiology
- Environmental epidemiology
- Occupational epidemiology
- Nutritional epidemiology
- Behavioral epidemiology

Information system

- Business Intelligence
- Supply Chain Information Systems
- Industrial Information Systems
- Decision Support Systems
- Smart Information Systems
- Health, Safety and Environment Information Systems

Keynote speaker



PROF. PETER GELL
Professor Of Environmental Management, Federation University, Australia



DR. NUKI AGYA UTAMA
Executive Director ASEAN Center For Energy



DR. YURDI YASMI
International Rice Research Institute (IRRI) Regional Representative For Southeast Asia, Phillipine



DR. LIEW KIAN HENG
Strategies And Liew Consultants, Singapore



PROF. ELCO VAN BURG
School Of Business And Economics At Vrije Universiteit Amsterdam, Netherlands



DR. IR. PATRICK VAN SCHIJNDEL
Technische Universiteit Eindhoven (TUE), Netherlands



DR. ZAINUL AKMAR ZAKARIA
Chemical Engineering Department, University Teknologi Malaysia (UTM), Malaysia



DRA. BAROKAH SRI UTAMI, APT., MM
Managing Director Pt Phapros Tbk, Indonesia



PROF. DR. JERRY MILLER
Department of Geosciences and Natural Resources, Western Carolina University



PROF. HADIYANTO
School Of Postgraduates Universitas Diponegoro, Indonesia



PROF. DR. SHABBIR H. GHEEWALA
Joint Graduate School Of Environment And Energy (JGSEE), King Mokut University, Thailand

Organizing committee:

Prof. Dr. Hadiyanto, M.Sc. (Chairman)
Dr. Thomas Trihadi Futanto, S.T., M.Eng. (Co Chairman)
Dr. drg. Dwi Surtiningsih, M.Kes. (Program)
Dr. Budi Warsto, S.S.L., M.St. (Publication)

Submission & Registration

<http://www.icenis.org>

Publication

All accepted papers will be published in Scopus Indexed Proceeding E3S Web of Conferences and selected papers will be published in International Journal of Renewable Energy Development (Scopus indexed) and HAYATI Journal of Biosciences (Scopus Q3)



Contact

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+62 813 2647 7628 (Prof. Hadiyanto)
+62 812 2811 8006 (Silvia Nur Safa ah, S.E.)
+62 813 9085 6514 (Eko Pujiyanto)
Email : icenis (at) live.undip.ac.id

Conference Fees

	Before June 30 th , 2020	After June 30 th , 2020
Presenter		
Indonesian Presenter	IDR 30000000/2000000/ paper	IDR 30000000/2000000/ paper
International Presenter	USD 4000/ paper	USD 4000/ paper
Student presenter	IDR 30000000/2000000/ paper	IDR 30000000/2000000/ paper
Participant (Non Presenter)		
Indonesian Participant	IDR 10000000	IDR 10000000
International Participant	USD 1000/2020	USD 1000/2020

* The fee has been adjusted as per recommendation being the current situation of Indonesia Covid-19

* All amount fee for second paper IDR 10000000

* They author may submit maximum of 5 (five) articles, two articles as first author and the remaining two articles as co-author

	Early Birds a	Batch a
FULL PAPER SUBMISSION	Before May 30 th , 2020	Before June 30 th , 2020
ACCEPTANCE NOTIFICATION	On June 30 th , 2020	On July 30 th , 2020
FINAL MANUSCRIPT	Before June 30 th , 2020	Before July 30 th , 2020
DAILY REGISTRATION PAYMENT	Before June 30 th , 2020	Before July 30 th , 2020

<http://www.icenis.org>

The Organizing Committee

This conference has been organized by School of postgraduate studies, Universitas Diponegoro Semarang. The school currently coordinating 6 graduate multidisciplinary programs i.e Master program of environmental science, master program of energy, master program of epidemiology, master program of information system, doctoral program of environmental sciences, and doctorate program of Information system. The total students is currently 350 students among these 6 programs.

The website: <https://pasca.undip.ac.id>

Website of conference: <https://icenis.undip.ac.id>

The committee of 5th ICENIS 2020

Chairman : Prof. Hadiyanto, MSc

Vice chairman : Dr Thomas Putranto Triadi

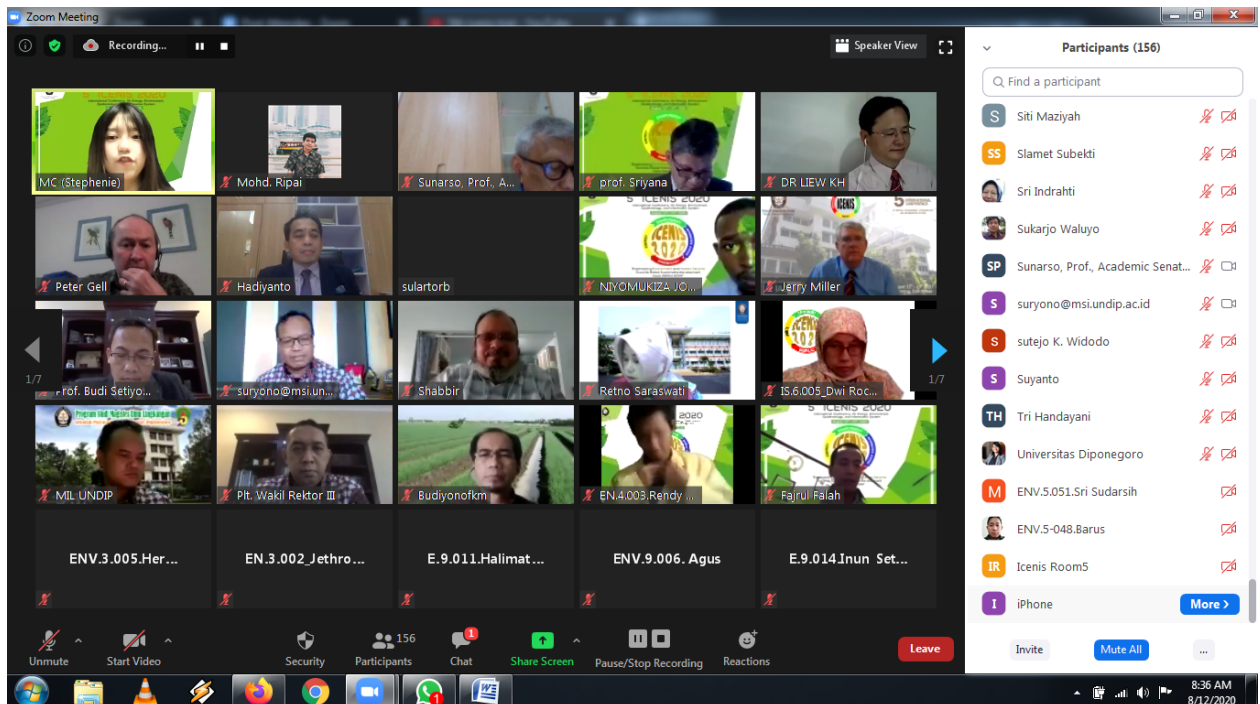
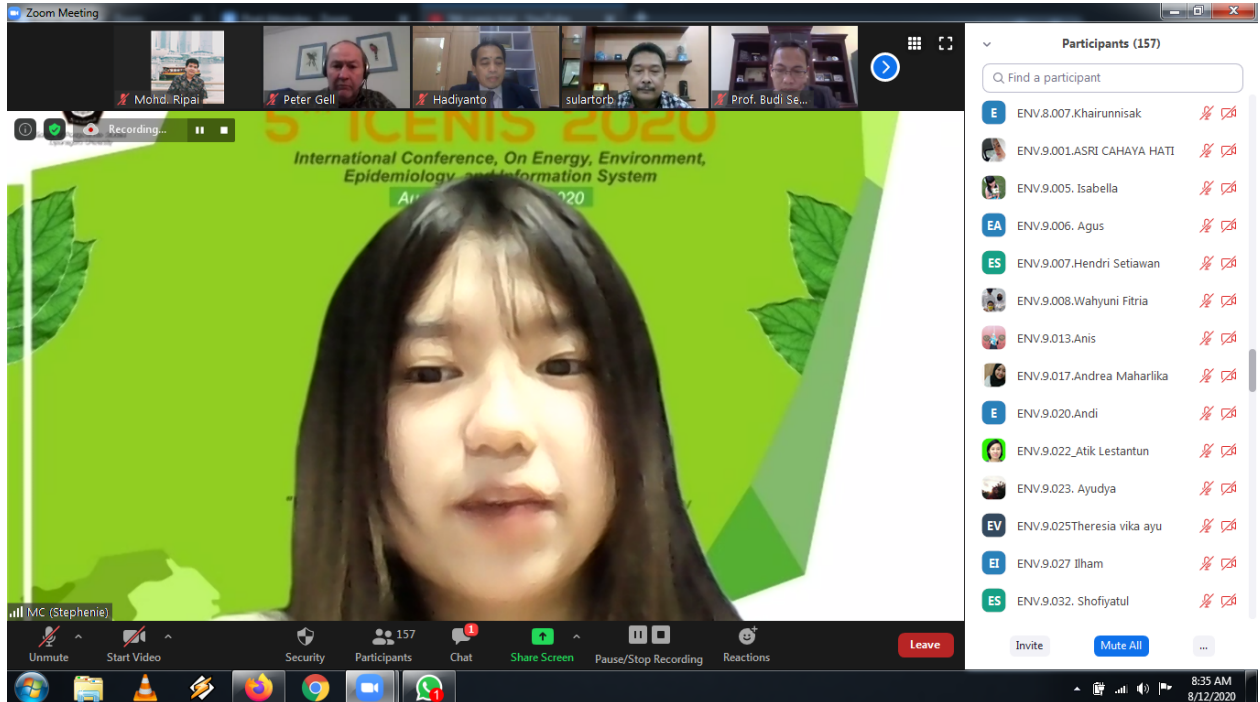
Programs : Dr Fuad Muhammad

Publications : Dr Budi Warsito

Supporting : Yunis, Alwi, Doni, Silvia, Fitri Handayani, Eko, Emma, Imma, Hastomo, Hamim, Rohmad, Gito, Joko, Lila

Some pictures from the conference

Opening Ceremony





2. The Chairman report



3. The remarks form Dean of School of Postgraduate Studies



4. Opening Remarks by The vice Rector, Prof. Budi Setiyono



Participants


The screenshot displays a Zoom meeting window with a grid of 20 participants. The interface includes a top bar with 'Recording...' and 'LIVE on Custom Live Streaming Service' indicators, and a bottom control bar with options like 'Unmute', 'Start Video', 'Security', 'Participants', 'Chat', 'Share Screen', 'Pause/Stop Recording', 'Reactions', and 'Leave'. The participants are arranged in a 4x5 grid:

- Row 1: MC (Stephanie), Mohd. Ripai, Sunarso, Prof., A..., prof. Srijana, DR. LIEW KH
- Row 2: Peter Gell, Hadiyanto, E.9.036.Poniman -, Jerry Miller, IWR1 UNDP Budi Se...
- Row 3: suryono@msiun..., Shabbir, Retno Saraswati, MILI UNDP, Budiyonofm
- Row 4: sulartorb, Tri Soeprbowati, Sudharso P. Hadi, Yurdi Yasmi (IRRI), Sudarmo Sudarno
- Row 5: Plt. Wakil Rektor III, Dwi Wulandari, ENV.4.005 Arum ..., inv.5-050.Nurhay..., Nilawati

The bottom control bar shows 175 participants, a chat icon with a notification, and system icons on the right indicating the time as 8:52 AM on 8/12/2020.

Keynote speaker Session I (Chaired by Prof. Sudharto P Hadi)



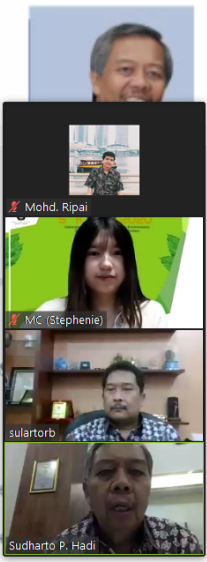
 **SUDHARTO P. HADI**
Professor in Environmental Management, Diponegoro University


Education. **Email:** sudhartophadi@yahoo.com
Drs, Faculty of Social and Political Sciences, Diponegoro University, Semarang, Indonesia (1979)
Master in Environmental Studies (MES), Faculty of Environmental Studies, York University, Toronto, Canada (1988)
PhD, School of Community and Regional Planning, University of British Columbia, Vancouver, Canada (1993).

Working Experiences **Research focuses**

- Lecturer, Diponegoro University (1980-
- Deputy, State Ministry for Environment (2000-2002)
- Rector, Diponegoro University (2010-2015)
- Vice Chairman, National Research Council (2015-

- Environmental Management
- Private Sector
- Social Impact Assessment


Mohd. Ripai
MC (Stephenie)
sulartorb
Sudharto P. Hadi

 **5th ICENIS 2020**

Zoom Meeting controls: Unmute, Start Video, Security, Participants (180), Chat, Share Screen, Pause/Stop Recording, Reactions, Leave. System tray: 8:58 AM, 8/12/2020.

Keynote 1: Prof. Elco

The image shows a Zoom meeting window displaying a presentation slide for Prof. dr.ir. Elco van Burg. The slide is titled "Prof.dr.ir. Elco van Burg" and includes the Vrije Universiteit Amsterdam logo. Below the name, it lists his title as "Professor of Organizational Theory, School of Business and Economics, Vrije Universiteit Amsterdam".

Education:

- BSc- Industrial Engineering and Management Science, TU Eindhoven (2004)
- BEEd- Theology, CGO (2007)
- MSc- Industrial Engineering and Management Science, TU Eindhoven (2006)
- MA- Theology, Utrecht University (2010)
- PhD- Management, TU Eindhoven (2010)

Working Experiences:

- Assistant professor, TU Eindhoven (2009-2011)
- Assistant professor, School of Business and Economics, VU Amsterdam (2011-2013)
- Associate professor, School of Business and Economics, VU Amsterdam (2013-2020)
- Organizational consultant and trainer, Lentera Papua, Papua, Indonesia (2014-2020)
- Financial consultant, Cenderawasih Air, Papua, Indonesia (2017-2020)

Research focuses:

- Organizational theory
- Social network theory
- Qualitative research
- Entrepreneurship

Email: Elco.van.burg@vu.nl

The Zoom interface shows a gallery view of participants, including Mondri Ripai, MC (Stephen...), sulartorb, and Sudharto P. Hadi. The meeting is titled "Zoom Meeting" and is being recorded. The taskbar at the bottom shows the time as 9:00 AM on 8/12/2020.

The second screenshot shows a presentation slide titled "FAITH AND DEVELOPMENT" with the subtitle "THE ROLE OF LOCAL RELIGIOUS ORGANIZATIONS IN COMMUNITY CHANGE IN PAPUA". The speaker is identified as "PROF. DR. IR. ELCO VAN BURG" from "VRIJE UNIVERSITEIT AMSTERDAM". The slide also features the VU logo and the text "LOOKING FURTHER". The Zoom interface shows a gallery view of participants, including Elco van Burg. The meeting is titled "Zoom Meeting" and is being recorded. The taskbar at the bottom shows the time as 10:51 AM on 8/12/2020.

2. Keynote 2 (Prof. Jerry Miller)

Zoom Meeting | You are viewing ICENIS 2020's screen | View Options

Mohd. Ripai | sulartorb | Sudharto P. Hadi | Jerry Miller | Sunarso, Prof.... | ENV.3.005.Her...

Recording... | LIVE | on Custom Live Streaming Service



Jerry R. Miller

Professor of Environmental Science

Education.
Bsc- Geology, Southern Illinois University (1982)
Msc- Geology, University of New Mexico (1985)
PhD- Geology, Southern Illinois University (1999)


Working Experiences

- Illinois State Geological Survey (1984-1986)
- Desert Research Institute, Reno, NV (1990-1996)
- Indiana University-Purdue University, Indianapolis (1996-1999)
- Western Carolina University (1999-Present)

Research focuses

- Water & Sediment Quality
- Hydrology
- Fluvial (river) Geomorphology
- River Restoration

Email:
jmiller@wcu.edu



5th ICENIS 2020

Unmute | Start Video | Security | Participants | Chat | Share Screen | Pause/Stop Recording | Reactions | Leave

9:01 AM 8/12/2020

Zoom Meeting | You are viewing ICENIS 2020's screen | View Options

Mohd. Ripai | sulartorb | Sudharto P. Hadi | Sunarso, Prof.... | ENV.3.005.Her... | prof. Sriyana

Recording... | LIVE | on Custom Live Streaming Service



5th INTERNATIONAL CONFERENCE

ON ENERGY, ENVIRONMENT, EPIDEMIOLOGY AND INFORMATION SYSTEM



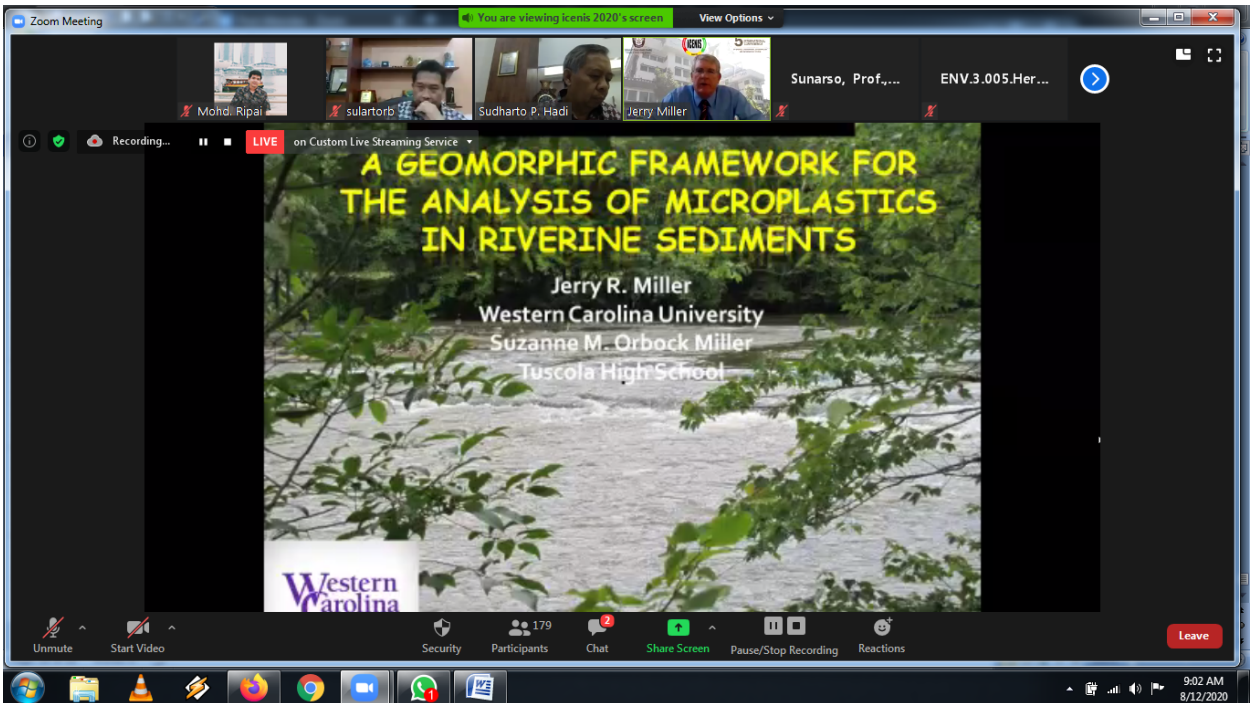
School of Postgraduate Studies
Diversity in Sciences, Unity in Impact



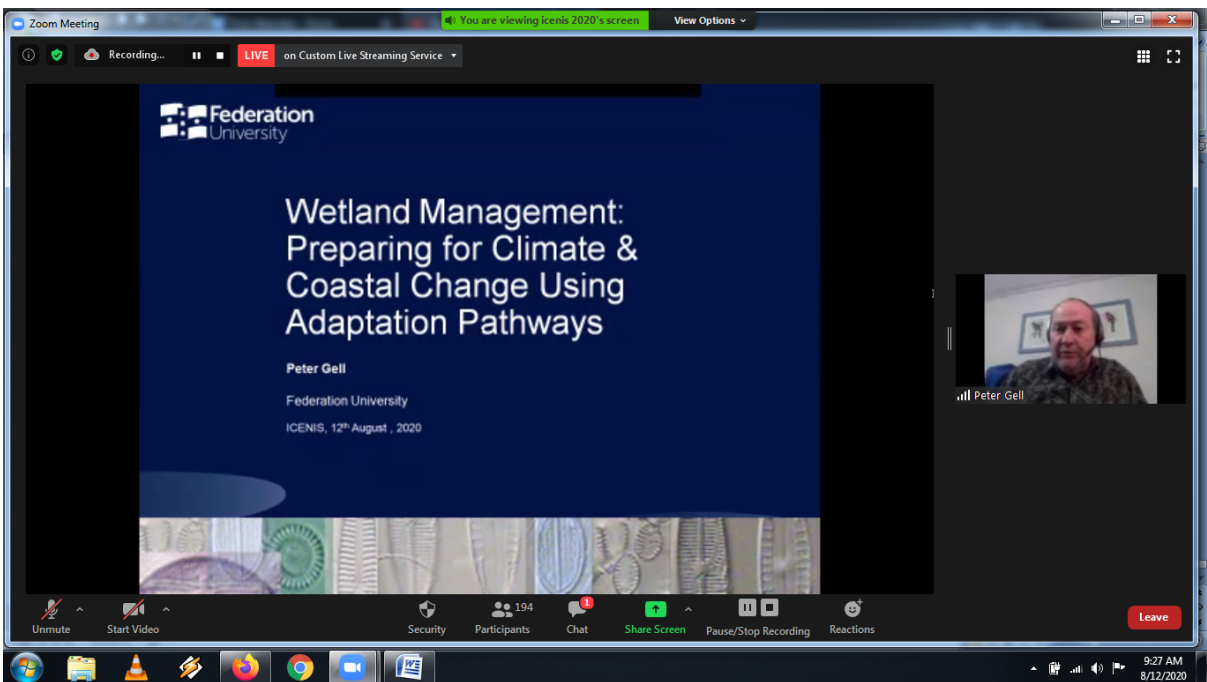
Jerry Miller

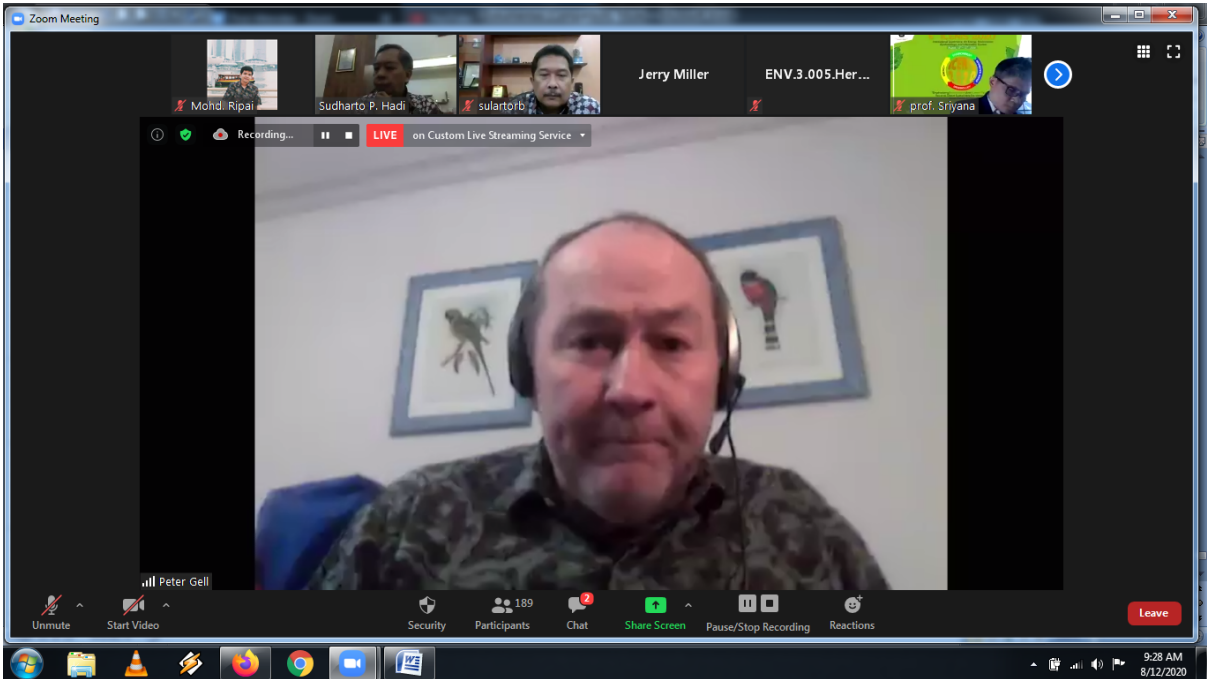
Unmute | Start Video | Security | Participants | Chat | Share Screen | Pause/Stop Recording | Reactions | Leave

9:02 AM 8/12/2020



3. Keynote 3 (Prof. Peter Gell)





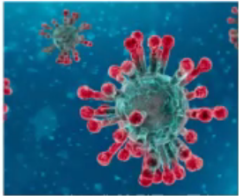
Keynote 5 (Dr Yurdi Yasmi)

Zoom Meeting | You are viewing kenis 2020's screen | View Options

Recording... | LIVE on Custom Live Streaming Service

COVID-19 worsens the SDG2 challenge – why?

- Economic recession and negative growth
- Restrictions of people's movement impacts agriculture activities
- Difficulties in getting agriculture inputs e.g. seeds, fertilizer, equipment
- Difficulties in bringing products to markets or consumers



Yurdi Yasmi (IRRI)

Unmute | Start Video | Security | Participants 172 | Chat | Share Screen | Pause/Stop Recording | Reactions | Leave

10:06 AM 8/12/2020

Keynote 6(Dr Liew Kian Heng)

Zoom Meeting

Mohd. Ripai | Sudharto P. Hadi | Yurdi Yasmi (...)

Peter Gell | ENV.5-031 Mah... | prof. Sriyana



DR. LIEW KH

Unmute | Start Video | Security | Participants 171 | Chat | Share Screen | Pause/Stop Recording | Reactions | Leave

10:18 AM 8/12/2020

Example for Parallel Session
ROOM 1



Zoom Meeting

Recording

Participants (35)

Find a participant

- EP.6-005 Mahda Pramesti R
- EP.6-007. Lintang Dian Saraswati
- ER EP.6-008. Rath Indraswari
- G Gltb55e-msa
- ID Irma Damayanti
- IB IS.5-003 Budi Sulistiyo
- R IS.6-007.Wingghayarie Patra Ga...
- JU Jati Utomo Dwi Hat...
- LA lala arastya
- M. Aried Rahman H...
- PW Plt. Wakil Rektor III
- RP Ratna Purwaningsih
- S sulartorb

EN_1002_Suyito

Evaluating the impact of technological adoption policy for rural coastal communities

Yudithia1, Edison2, Dwi Kristanti3, Tri Samnuzalsari4, Suyito5, and Wayu Eko Yudiantmaja2*

1. Secretary Office of the Regional House of Representatives of Kepulauan Riau, Indonesia
2. Department of Public Administration, Universitas Maritim Raja Ali Haji, Indonesia
3. Department of Public Administration, Universitas Terbuka, Indonesia
4. Department of Sociology, Universitas Maritim Raja Ali Haji, Indonesia
5. Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin (UniSZA), Malaysia

1:03 PM 8/12/2020

ROOM 2

Zoom Meeting

You are viewing EN.4-002.Moh Nurhadi's screen

Recording

METHODOLOGY DESIGN

Literature Review

Municipal Waste Generation

Classification & Composition of Waste

Scenario 1 Without recycling

Scenario 2 Low Recycling rate

Scenario 3 High recycling rate

Caloric Value Analysis

Non-recycle waste potential for RDF

$$Eh = \sum_{i=1}^n LHV_i \cdot m \cdot f_i \cdot q \quad (1)$$

Where Eh is heat energy potential from all type of waste, LHV_i (Low Heating Value) is calorific value of waste type i (kcal/kg) while $m \cdot f_i$ is fraction of waste type i (without unit). The value q indicates total weight of waste.

The material recovery of plastic and paper according to scenario 2 and 3 will reduce the heat energy potential (Eh). The amount of calorie deduction is equal to the fraction of recycling. The heat energy of recycled fraction could be calculated using equation (2):

$$Ehr = \sum_{i=1}^n LHV_i \cdot m \cdot f_i \cdot r \cdot r_i \cdot q \quad (2)$$

Where Ehr is heat energy from recycle waste taken while r is ratio of recycling. Value of r for scenario two is 0.25 (25%) while scenario 3 is 0.5 (50%) for PET, HDPE, and paper. LHV_i is heat energy from a wet waste that influenced by its moisture. LHV could be determined from HHV (High Heat Value) with the following equation:

$$LHV = HHV \cdot (1 - w) - 584.85w \quad (3)$$

Where HHV is heat energy of a dry waste in kcal/kg, while w is water content and 584.85 is a heat constant in vaporizing water at temperature of 25°C [40]. Heat energy of non-recycled waste (Ehm) is accounted by deducting overall heat energy of waste (Eh) by heat energy of recycling waste (Ehr) through the equation below:

$$Ehm = Eh - Ehr \quad (4)$$

EN.4-002.Moh Nurhadi

Unmute Start Video

Participants 12 Chat Share Screen Record Reactions

1:07 PM 8/12/2020

Zoom Meeting

Recording

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graph TD
    A[Literature Review] --> B[Municipal Waste Generation]
    B --> C[Classification & Composition of Waste]
    C --> D1[Scenario 1  
Without recycling]
    C --> D2[Scenario 2  
Low Recycling rate]
    C --> D3[Scenario 3  
High recycling rate]
    D1 --> E[Calorific Value Analysis]
    D2 --> E
    D3 --> E
    E --> F[Non-recycle waste potential for RDF]
        
```

METHODOLOGY DESIGN

$$Eh = \sum_{i=1}^n LHV_i \cdot mfi \cdot q \quad (1)$$

Where Eh is heat energy potential from all type of waste, LHV_i (Low Heating Value) is calorific value of waste type i (kcal/kg) while mfi is fraction of waste type i (without unit). The value q indicates total weight of waste.

The material recovery of plastic and paper according to scenario 2 and 3 will reduce the heat energy potential (Eh). The amount of calorific deduction is equal to the fraction of recycling. The heat energy of recycled fraction could be calculated using equation (2):

$$Ehr = \sum_{i=1}^n LHV_i \cdot mfi \cdot rr \cdot q \quad (2)$$

Where Ehr is heat energy from recycle waste taken while rr is ratio of recycling. Value of rr for scenario two is 0.25 (25%) while scenario 3 is 0.5 (50%) for PET, HDPE, and paper. LHV_i is heat energy from a wet waste that influenced by its moisture. LHV could be determined from HHV (High Heat Value) with the following equation:

$$LHV = HHV \cdot (1-w) - 584,85w \quad (3)$$

Where HHV is heat energy of a dry waste in kcal/kg, while w is water content and 584,85 is a heat constant in vaporizing water at temperature of 25°C [40].

Heat energy of non-recycled waste (Ehm) is accounted by deducting overall heat energy of waste (Eh) by heat energy of recycling waste (Ehr) through the equation below:

$$Ehm = Eh - Ehr \quad (4)$$

1:09 PM
8/12/2020

ROOM 3

Zoom Meeting

Fuad (Moderator)

Recording

Unmute

Start Video

Participants 12

Chat

Share Screen

Record

Reactions

Leave

1:11 PM
8/12/2020

Zoom Meeting You are viewing EN.6.001.Satya's screen View Options

Recording

File Home Insert Design Transitions Animations Slide Show Review View Tell me what you want to do... Thao Pinem Share

Clipboard Paste Copy Cut New Slide Format Painter Section Slides

Font Paragraph Drawing

1 2 3 4 5 6

Slide 3 of 10 Indonesian

Unmute Start Video Participants 12 Chat Share Screen Record Reactions Leave

1:12 PM 8/12/2020

Zoom Meeting You are viewing EN.6.001.Satya's screen View Options

Recording

Background

- ❑ Indonesia's Third National Communication on GHG emission (2017) predicted [redacted] sector (O&G and coal industry) will become the highest GHG contributor for 2030
- ❑ Indonesia's GHG emission reported thru Nationally Determined Contribution (NDC) was estimated by Tier-1 Intergovernmental Panel on Climate Change (IPCC) method, while the O&G company adopts the American Petroleum Institute (API) Compendium method
- ❑ This leads to asynchronous GHG emission contribution of O&G industry to national GHG emission
- ❑ Consistent and accurate GHG inventory is critical to determine the status and trend of GHG emission changes, improve accountability as well as to evaluate the effectiveness of the reduction strategy

Unmute Start Video Participants 12 Chat Share Screen Record Reactions Leave

1:13 PM 8/12/2020

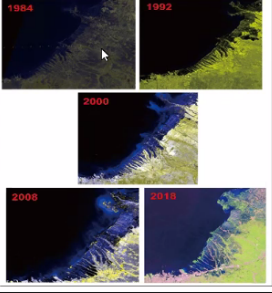
ROOM 4

Zoom Meeting You are viewing ENV. 1-003, (Niyomukiza & Sriyana)'s screen View Options

Recording Gallery View

DATA AND STUDY LOCATION Cont'd....

- Data used in this research was obtained from Landsat satellite imagery recorded on 23 February 1984, 28 June 1992, 23 April 2000, 24 April 2008, and a drone captured on 5 June 2018.
- The overlay from Landsat images and RGB overhead images were corrected through radiometric and geometric check
- They were then integrated with the administrative limit from Morosari district in Demak regency and the border of Semarang City (Tanjung Mas).



ENV. 1-003, (Niyomukiza & Sriyana)

Unmute Start Video Participants 13 Chat Share Screen Record Reactions Leave

1:14 PM 8/12/2020

Zoom Meeting You are viewing ENV. 1-003, (Niyomukiza & Sriyana)'s screen View Options

Recording Gallery View

Analytical Technique

The processing method of the Landsat images consists of several steps as listed below;

- The initial stage of data development is conducted through correlation with the standard procedure issued by the data supplier.
- Early development began by synchronizing the spatial resolution between Landsat-4 MSS and Landsat series TM.ETM+.
- Images were analyzed and then geometrical and radiometric corrections were made.
- The development of RGB (Red Green Blue) composite for each imaging acquisition.
- Digitizing the fourth RGB image as an analogy by digitalizing it on screen.
- Analysis and calculation are done through the process of digitizing of each year's image so that it is possible to find out the changes both from accretion and abrasion.

ENV. 1-003, (Niyomukiza & Sriyana)

Unmute Start Video Participants 13 Chat Share Screen Record Reactions Leave

1:14 PM 8/12/2020

Zoom Meeting | You are viewing ENV. 1-003. (Niyomukiza & Sriyana's screen) | View Options

Recording

RESULTS AND DISCUSSION

According to the coastline length calculation resulted from digitation, the border area length between Semarang – Demak (Tanjung Mas, Terboyo Wetan, Terboyo Kulon, and Trimulyo village) and Demak Regency (villages along the coast in Demak Regency) are as follows;

Table 1. Coastline Length and Rate of coastline changes

Year	Coastline length (Km)	Rate of coastline changes (Km/year)
1984	48.2	-
1992	57.9	1.2
2000	63.7	0.7
2008	73.5	1.2
2018	92.6	2.1

ENV. 1-003. (Niyomukiza & Sriyana)

Unmute | Start Video | Participants: 13 | Chat | Share Screen | Record | Reactions | Leave

1:15 PM 8/12/2020

ROOM 5

Zoom Meeting | Recording

Icenis Room5

ENV.1-010 Muhammad J... | Mohd. Ripai (Docume... | Haryono Huboyo

YUNA SNSD | ENV.1-013 (Yum... | aije | ENV.06-002.Tozan Ajie | ENV.6-001.Nurakhmi


ENV.1-009.Ahm... | Haryono Huboyo | ENV.1.011 Raffi D Cahyo | IS.1-007.Chashif Syadzali

ENV 1.015 Novi... | ENV.4-012 T. Listyani R... | ENV.7.002.Nani Hariha... | ENV 1-014

100% | 1:18 PM 8/12/2020

Zoom Meeting You are viewing ENV.1.011 Raffi D Cahyo's screen View Options

Recording



ICENIS 2020

The Influence of Land Use To River Water Quality Level by Using The Water Quality Index Of National Sanitation Foundation (WQI-NSF) Method (Case Study: Klampok River, Semarang District)

Winardi D Nugraha, Mohammad Rafif D Cahyo, and Nurandani Hardyanti
Environmental Engineering Department, Faculty of Engineering, Diponegoro University, Semarang, 50275, Indonesia

Unmute Start Video Participants 17 Chat Share Screen Record Reactions Leave

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Introduction

The increasing rate of population growth has resulted in various environmental degradations.

Land use change is a form of environmental degradation which is defined as a form of human intervention on land in order to meet the needs of life both material and spiritual (Arsyad 2006).

Activities on the Klampok River have the potential to cause the river to experience a decrease in water quality due to agricultural, industrial, and residential activities as well as the influence of land use changes.

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Methodology

Sampling Location

This study was conducted in the Jragung watershed, in the Klampok Sub-watershed, Semarang Regency, Central Java.

Water sampling is carried out at 4 sampling points that have been determined based on the condition of the distribution of sub-watersheds, land use, topography, river physical condition, and administrative boundaries.

Water sampling at the sampling location for each segment was carried out on rainy season on March 4th, 2020.

No	Sampling Point	Coordinates
1.	Sampling Point 1 Located in Jatijajar Village, Bergas Sub-district	7° 12' 26" S and 110° 25' 26" E
2.	Sampling Point 2 Located in Kedung Mbelon, the border between Jatijajar-Derekan, Bergas Sub-district	7° 11' 59.41" S and 110° 25' 58.82" E
3.	Sampling Point 3 Located in Ngenpon Village, Bergas Sub-district	7° 11' 33.72" S and 110° 26' 1.50" E
4.	Sampling Point 4 Located in Pringapus Village, Pringapus Sub-district	7° 11' 37.99" S and 110° 27' 56.00" E

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Methodology

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4.	Sampling Point 4 Located in Pringapus Village, Pringapus Sub-district	7° 11' 37.99" S and 110° 27' 56.00" E

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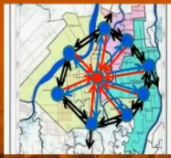
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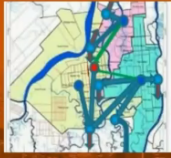
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RESULT AND DISCUSSION

Expectation



Reality



The growth of the KTM Telang downtown area is expected to provide a positive breakthrough for the economic growth of the surrounding area or the region region behind it (hinterland), through the acculturation of the sector or subsector base as a driving force for the regional economy and economic linkages between regions

Problem Identification

- Infrastructure Development at the KTM Center has no significant impact on the economic growth of the hinterland region
- There is no influence of activities in the hinterland on the development and economic growth at the KTM center (the amount of leakage and there is no product added value)
- Rivers and canals that used to be a means of transportation, now become a barrier because of high costs.

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Phenolic compound derived from microwave-assisted pyrolysis of coconut shell: Isolation and antibacterial activity testing

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Abstract. Indonesia is rich in natural resources, coconut plantation being one of them. The coconut processing industry produces coconut shell (CS) waste. The most effective technique to increase the value of this waste is to convert CS biomass through pyrolysis process. This research focuses on intensification of conversion process of CS by Microwave-Assisted Pyrolysis (MAP) to obtain PA. PA contains phenolic compounds which have antibacterial properties so they can be formulated as an antibacterial agent. CS has moisture and ash content of 8.89% and 0.21%, respectively. PA was produced from the MAP of CS at 600W at 450°C and 500°C for 10, 20, and 30 minutes. The PA was extracted using ethyl acetate to obtain phenolic contents. Optimum pyrolysis condition was found at 400°C for 30 minutes and yield of PA was determined at 32.20 g with total phenolic content (TPC) of 112.13 mg GAE/g. The inhibition zone of phenolic extract from coconut shell (PECS) using *E. Coli* was determined within 22-25 mm that quantitatively PECS can effectively kill bacteria. PECS by MAP and its application as an antibacterial agent has never been performed, so this work is an important contribution in the intensification of pyrolysis and in medical field.

Keyword: *Antibacterial agent, Biomass, Microwave-assisted Pyrolysis, Phenolic compounds*

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1 Introduction

Indonesia is the second largest coconut producing country in ASEAN after Philippines [1]. The total area of Indonesian coconut plantations in 2018 reached 3.547 million hectares with a total production of 2.866 million tons. The development of coconut production in Indonesia had tendency to increase by 1.95% per year in 1980 - 2018 period [2]. The high demand for processed coconut exports has resulted in increased waste in the form of coirs and coconut shells (CS). A coconut produces 30% fiber while 15% - 19% of the total weight is the weight of the CS [3]. Even as organic waste, the CS cannot decompose quickly in the environment. Therefore, the amount of the waste continues to increase along with the increase in processed coconut products. One of the ways to utilize CS into available products is thermochemical conversion which is pyrolysis. Products of the pyrolysis process include charcoal, tar, gas and pyroligneous acid (PA) [4]. PA is smoke from the pyrolysis process which is condensed into a liquid product consisting of water, alcohol, organic acids, phenols, aldehydes, ketones, esters, furans, pyran derivatives, hydrocarbons, and nitrogen compounds [5]. PA compounds have antibacterial, anti-oxidant and anti-inflammatory properties that are prospective to be utilized for medicinal and pharmaceutical products formulations [6].

Based on its composition, the CS is composed of 3 main components: 26.60% of cellulose, 27.70% of hemicellulose, and 29.40% of lignin [7]. The hemicellulose compound can be degraded at temperatures of 200°C – 260°C, cellulose at 240°C–350°C, while lignin at 280°C – 500°C [8]. High cellulose and hemicellulose content contribute to higher bio-oil yields, while high lignin content increases biochar yield [9]. Although lignin has a high level of resistance to thermal degradation, decomposition of lignin compounds produces charcoal, carboxylic acids, methanol, phenols and other aromatic compounds in liquid products [10]. Therefore, the high lignin content in a material can produce high phenolic compounds.

Pyrolysis consists of two processes: slow pyrolysis and fast pyrolysis. Slow pyrolysis is a slow process of thermal degradation of organic components in biomass due to the absence of oxygen to a final temperature of approximately 500°C [8]. Fast pyrolysis is a process of pyrolysis using high temperature where raw materials are heated quickly in the absence of air so as to produce vapor and dark brown liquids. This process is more sophisticated and can be carefully controlled to provide high yields on liquid products [11]. Previous researches with these following raw materials have been conducted include slow pyrolysis walnut shells to produce activated charcoal [12], produce PA from palm kernel shell [13] and *Rosmarinus officinalis* leaves [14], produce activated charcoals from rice husk [15], and produce liquid smoke from young coconut, bamboo and durian rind [16]. This research was conducted using conventional thermal heating with an external heater such as a furnace or hot mantle. This heating system is relatively slow and inefficient. Therefore, intensification of the process was carried out. Therefore, the pyrolysis could go more quickly and saved energy by using Microwave-Assisted Pyrolysis (MAP). Research using MAP has been carried out on several biomass such as oil palm fiber to make hydrogen gas [17] and pyrolysis liquid oil [18], palm kernel shell to produce anti – bacterial agent [19] and bio-oil [20], characterization of empty fruit bunch for MAP [21], and pineapple waste to produce PA [22]. However, from a number of previous studies, there have not been any studies found on the application of MAP to CS aimed at utilizing PA as an antibacterial agent.

MAP was developed as an alternative heating source in the pyrolysis process. Volumetric heating properties and better control and uniform heat distribution can be achieved through heating on MAP [23]. MAP can prevent the formation of secondary reactions thereby increasing the quality of the products. MAP technology has the potential

to save energy and reduce process costs. In producing PA, MAP is influenced by several factors including the type of reactor, particle size, pressure, temperature, power level, residence time, flow carrier gas and the use of activated carbon [24]. Therefore, this research investigated the effect of changes in time and temperature in the MAP process to determine the feasible conditions for producing the most PA.

One of the interesting benefits of PA to be investigated is its antibacterial properties. Therefore, the extracts of phenolic compounds in this study were tested on *Escherichia coli* bacteria. In previous studies, PA as the result of the CS MAP process had not been tested as an antibacterial agent. Therefore, this study contributes to the effect of MAP operating conditions on PA products and testing phenolic extracts from coconut shell (PECS) from the results of MAP as an antibacterial agent that can be utilized in the medical field. Specifically, the purpose of this study was to determine the effect of time and temperature on PA production in MAP as well as the characteristics of phenolic extracts as an antibacterial agent.

2 Methodology

2.1 Materials

The materials used in this study included 1) CS from *Cococs nucifera* originating from Bantul, Indonesia; 2) commercial activated carbon granule (C1452-32112392) from HmBG Chemicals, Malaysia; 3) nitrogen gas; 4) ethyl acetate (EA) (99.5%, grade AR); 5) Whatman no. 4 filter paper; 6) rotary evaporator (Heidolph, Germany); 7) UV-Vis spectrophotometer (Shimadzu, Japan).

2.2 Methods

2.2.1 Pre-treatment

CS was cleaned of fiber and dirt, then dried in the sun for 7 days. CS has been dried was subsequently reduced in size by using a hammer mill. Then sieving process was performed so that the same size approximately 1 - 1.18 mm was obtained. The small size CS was stored in a place protected from humidity. Based on the raw material test, the CS used for PA production in this study had water content of 8.89% and ash content of 0.21%.

2.2.2 Microwave-assisted Pyrolysis (MAP)

Microwave-assisted pyrolysis (MAP) was carried out referring to a study conducted by Abas [18] with modification of raw material size of 1-1.18 mm. 100 g materials and 50 g of activated carbon were dried at 105°C for 24 hours. Furthermore, both were put into a reactor made of quartz glass. Thermocouple type-R was mounted on the reactor and connected to the PicoLog Data Logger System (PicoLog Recorder software, version 5.23.0) to show changes in temperature during the reaction. Nitrogen gas was flowed at 2 L/min, supplied from the top of the reactor for 15 minutes before the pyrolysis process was conducted. Other modifications were the power output on the microwave of 600W. Pyrolysis temperature was controlled at 400°C and 450°C, while cooling water was set at 6°C for the condensation process. The residence time of the MAP process was carried out in 10, 20 and 30 minutes. Liquid and gaseous products went through the condenser column and was collected in a round bottom flask (at the bottom of the condenser) as a mixture of

PA and bio-oil, while the uncondensed gas was discharged into the environment. Biochar formed in the reactor was called a solid product. The end of this process was to determine the percentage of solid, liquid, and gases product based on the mass of each product.

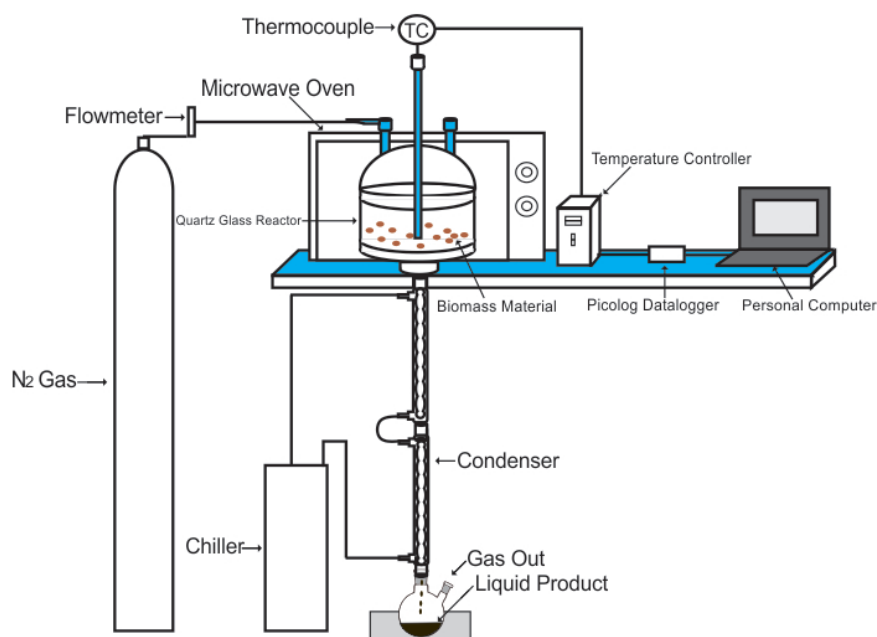


Fig. 1. Microwave-Assisted Pyrolysis

2.2.3 Purification using Extraction Process

Pyrolygneous acid (PA) is obtained from the liquid product from the pyrolysis process. The liquid product was filtered using Whatman no. 4 filter paper to separate PA from bio oil and other impurities. Ethyl acetate (EA) solvent was added to the PA referring to the research conducted by Loo et al. [25], with these following modifications: PA was extracted using EA at a ratio of 1: 1 using a 100 mL separatory funnel, was shaken for 3 minutes at room temperature and let it stand for 30 minutes to form two layers. The upper layer was collected as an organic layer and the lower layer as a mixture layer was extracted for the second time using fresh EA. The extracted PA was concentrated using a rotary evaporator (Heidolph, Germany) at a pressure of 120 mBar and a temperature of 80°C to 1/3 of the initial volume. Then phenolic extract from coconut shell (PECS) was stored in a desiccator.

2.2.4 Total Phenolic Content (TPC)

Total phenolic content (TPC) was determined by using the Folin Ciocalteu reagent as was performed by Ma et al. [4], Gallic acid at a concentration of 10 – 100 µg/mL was used as the standard reference for making calibration curves. Each sample of 1 mL (100 µg/mL) was mixed with 1 mL of 50% (v/v) of Folin-Ciocalteu phenol reagent in the test tube. The mixture was shaken for 30 seconds and left at room temperature for 2 minutes. After 2 minutes, 1 mL of sodium carbonate (Na₂CO₃) solution was added to neutralize the mixture. The mixture was shaken for 10 seconds and allowed to stand in a dark place for 2 hours at room temperature. Tests were carried out in a dark room because the reagent was sensitive

to light and to reduce UV interference from redox reactions. Measurement of absorbance of a blue mixture was recorded at 765 nm using a UV-Vis spectrophotometer (Shimadzu, Japan). Results were reported as averages expressed as micrograms of gallic acid equivalents (GAE) per milligram of sample ($\mu\text{g GAE/mg}$)

The TPC concentration was calculated as suggested by Abdelhady et al. [26], as follow:

$$\text{Total phenolic content (TPC), } \frac{\text{mg GAE}}{\text{g}} = \frac{C \times V}{M} \tag{1}$$

Where:

C = concentration of Gallic acid established from the calibration curve in mg/ml

V = the volume used during assay in mL

M = mass of the extract used during assay in g

2.2.5 Application as Antibacterial Agent

The antibacterial test was conducted by the Central Laboratory of Health and Testing of Medical Apparatus in Central Java. The bacteria used for testing was *Escherichia coli* with the disk diffusion method. The reaction was the formation of a clear zone around the phenolic compound, then the diameter of the clear zone was generated to determine the antibacterial strength.

3 Results and discussion

3.1 MAP Process

The study intended to investigate the relationship between product yield (solid, liquid and gases) with much emphasis on the PA product (liquid), residence time, and temperature. In this work, the pyrolysis process was conducted in different operation condition, in which its sample was mentioned as S1 to S6 as detected in Table 1. The percentage of product yield of MAP were calculated as weight percent (wt %) with initial CS of 100 gram.

Table 1. Comparison of MAP product yield for various operation condition

Symbols	Temp (°C)	Time (min)	Char (wt %)	Liquid (wt %)	Gas (wt %)
S1	400	10	33.28	26.62	40.10
S2	400	20	33.39	27.63	38.98
S3	400	30	33.41	32.20	34.40
S4	450	10	37.63	20.94	41.43
S5	450	20	38.24	24.91	36.86
S6	450	30	33.85	30.03	36.12

The effect of temperature change was proven when the thermal heating level increased to 450°C, the liquid yield decreased while the gas yield increased. Operating conditions at high temperatures cause larger molecules such as liquids to split to produce gas. This is consistent with previous research [27]. The effect of residence time was proven when residence time increased to 30 minutes, liquid yield increased while char and gas yield decreased. This is consistent with previous research [13]. Low temperatures and long

residence times support char production, while higher temperatures and short residence times result in high liquid product production [28].

3.2 Total Phenolic Content (TPC)

The TPC was determined from linear equation of gallic acid calibration curve with the specific at Fig. 2 was expressed in microgram which equals to gallic acid per milligram sample ($\mu\text{g GAE/mg}$). Absorbance of mixtures containing gallic acid, Folin Ciocalteu and sodium carbonate increases proportionately with increasing concentrations of gallic acid [29]. The calculation results of TPC S1 to S6 are shown on Table 2.

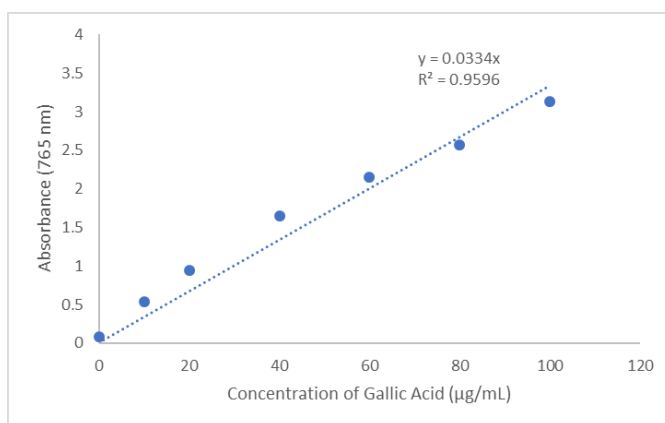


Fig. 2. Gallic acid calibration curve

Table 2. TPC of PA extracts

Symbol	S1	S2	S3	S4	S5	S6
PA (g)	26.62	27.63	32.20	20.94	24.91	30.03
TPC (mg GAE/g)	85.03	96.41	112.13	72.90	90.87	111.68

In this work, the highest TPC of 112.13 mg GAE/g was observed in S3 under MAP operating conditions at 400°C for 30 minutes. Because phenolic compounds are not decomposed in low temperature conditions. Furthermore, some phenolic compounds that dissolve in water are extracted into water in lower temperature conditions due to low evaporation of water [4]. The phenolic structure can be maintained at lower temperatures under lower vapor pressure in the reactor because some phenols are primary pyrolysis products and are produced mainly by cracking $\beta - \text{O} - 4$ aryl ether bonds in lignin [30]. Previous studies reported that TPC in PA extract of pineapple biomass was 2.67 ± 0.14 mg GAE [22] and palm kernel shell was 49.96 mg GAE/g [29]. This shows that TPC in CS is greater than pineapple biomass and palm kernel shell.

3.3 Antibacterial Activity

Six samples of phenolic extract from coconut shell (PECS) were tested for their antibacterial activities at the Central Laboratory for Health and Medical Apparatus Testing in Central Java. The results are shown in Fig. 3.

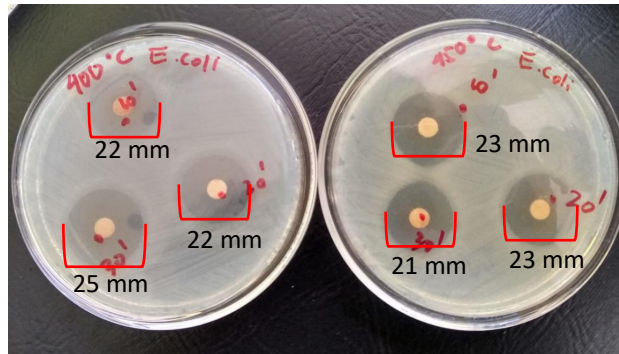


Fig. 3. Antibacterial activity of PECS on inhibition of *Escherichia coli*

According to Davis dan Scout [31], anti-bacterial activity in the clear zone test is divided into the following: the diameter of zone of inhibition which is less than 5 mm is categorized as weak, zone of inhibition of 5 - 10 mm is categorized as medium, zone of inhibition of 10 - 20 mm is categorized as strong, and zone of inhibition more than 20 mm is categorized as very strong. The test results showed the antibacterial activity of each sample of coconut shell phenolic compounds was very strong. Samples that had the largest zone of inhibition diameter were at S3 (25 mm) with MAP 400°C operating conditions for 30 minutes. The diameter of inhibition zone can be influenced by TPC concentration. The higher concentration leads to the higher antibacterial activity [32]. The reduction of important organic ions that enter the cell results in inhibited growth to death of the cell [33]. Damage to the bacterial cell wall results in decreased permeability of the cytoplasmic membrane to transfer important ions needed by bacteria. The high phenolic compounds in PECS can denature proteins contained in bacterial cell walls so that the inhibitory ability of PECS can act as an antibacterial agent.

4 CONCLUSION

From this study, MAP of CS samples under different operating conditions showed the highest liquid product acquisition at 400°C with residence time of 30 minutes. Based on the TPC test of PA extract (PECS), PA from MAP with this condition has the highest concentration of 112.13 mg GAE/g and shows the largest bacterial growth zone of inhibition, which is 25 mm. However, more studies must be carried out prior to any commercialization attempts for this compound.

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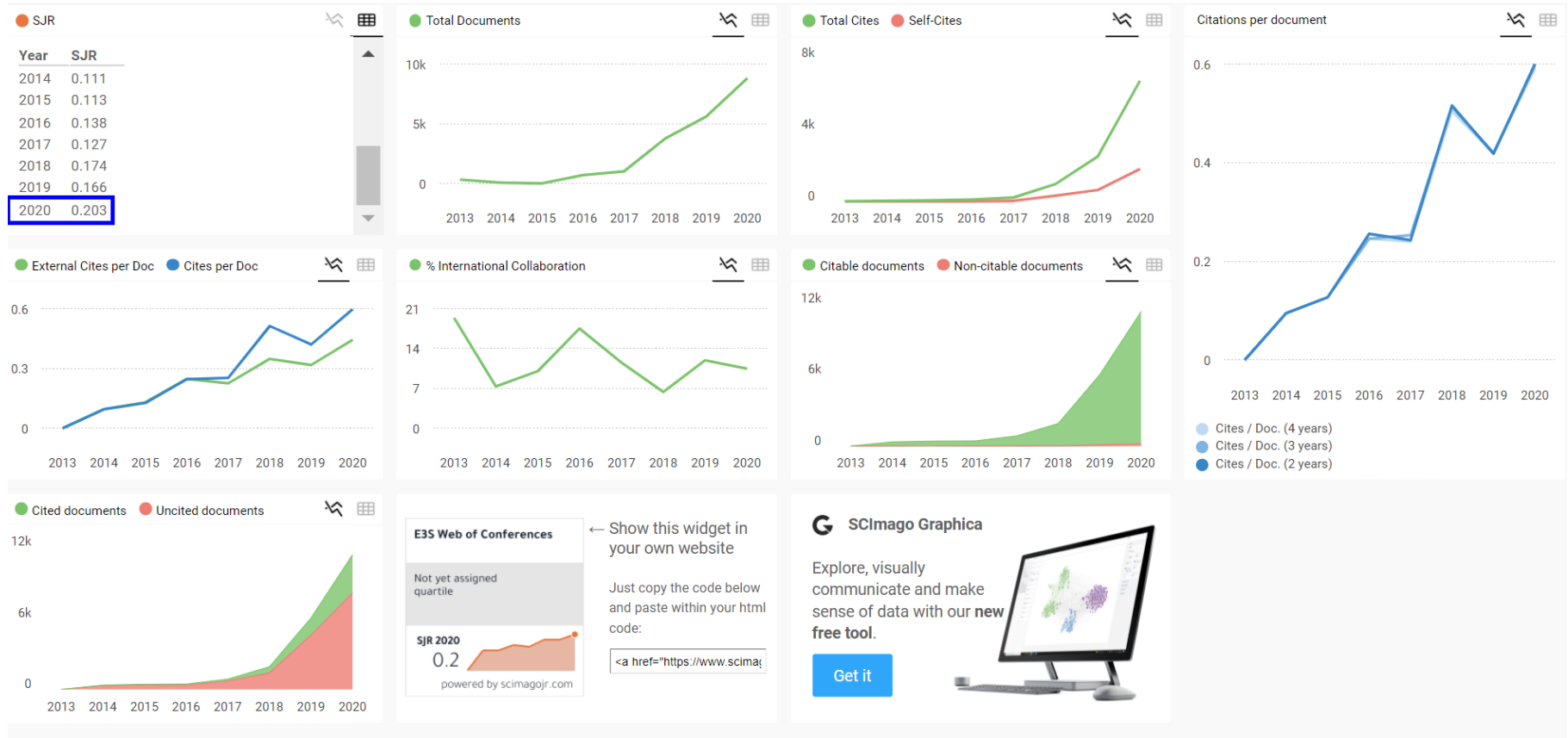
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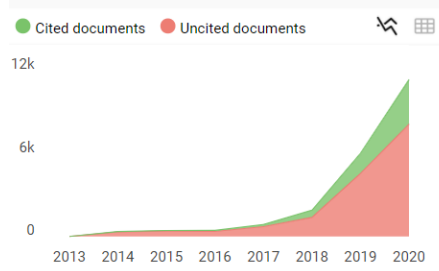
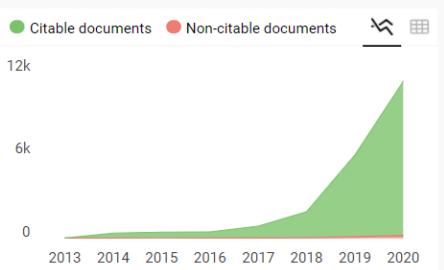
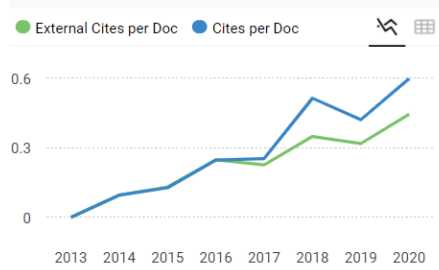
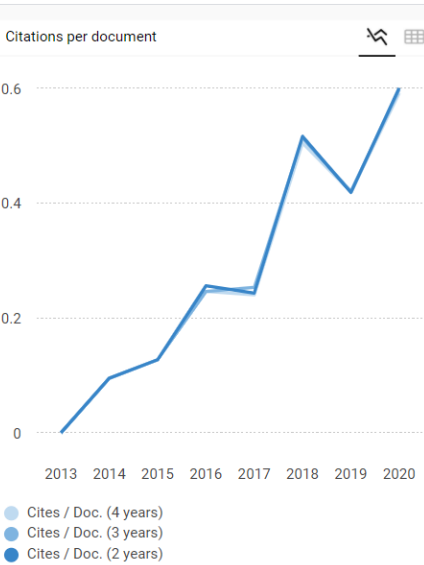
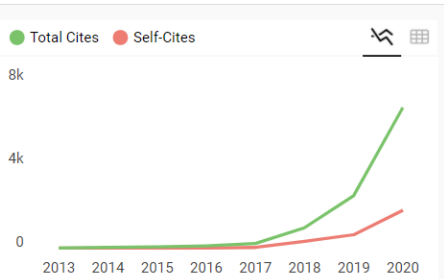
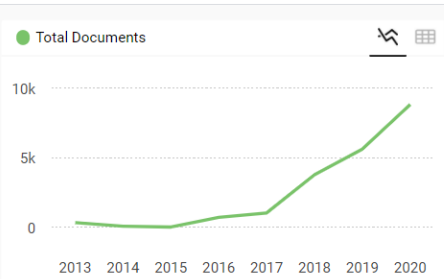
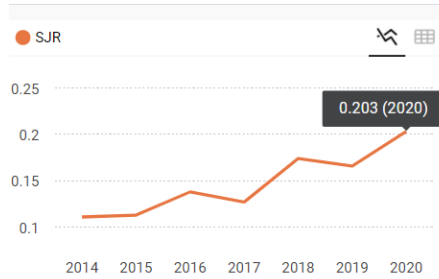
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