

# FIRST 2016

Forum In Research, Science, and Technology

ISSN: 2461-0739



## Renewable Energy for Sustainable Development

# PROCEEDING INTERNATIONAL CONFERENCE

OCTOBER 18-19, 2016



Held by:



SUPPORTED BY:



International Conference  
**Forum in Research, Science, and Technology (FIRST) 2016**

October 18 – 19, 2016  
Palembang, Indonesia

Held by:



State Polytechnic of Sriwijaya – Indonesia

## CONTENTS

|   |       |
|---|-------|
| Contents .....  | ii    |
| Editorial Board .....   | x     |
| Remark from Director of State Polytechnic of Sriwijaya, ..... | xi    |
| Message from Chairman of th Committee .....                   | xiii  |
| Keynote Speaker .....   | xv    |
| Invited Speaker.....  | xvi   |
| Scientific Committee.....                                     | xvii  |
| Organizing Committee .....                                    | xviii |

### Sub Theme A – Environment

The Effect of The Environment on Biodegradation Time of Biodegradable Plastic from Rubber Cassava Starch with Using Sorbital and Glycerol Plasticizer

*By: Sofiah, Martha Aznury, Astria Handayani (Politeknik Negeri Sriwijaya, Palembang, Indonesia).....* A1-A4

Treatment of Soil Bearing Capacity Using Bio-Enzyme for The Future

*By: Adi Prawito, Tony Hartono Bagio, Sri Wiwoho Mudjanarko, Makno Basoeki, Nandar Astowo (Universitas Narotama, Surabaya, Indonesia).....* A5-A9

Potentials Energy and Reduction of Carbon Emissions from Crude Palm Oil Production - Case Study in PT Dendy Marker Indah Lestari Sumatera Selatan

*By: Annastassia Ayu Arcitra, Hariyadi, Dwi Setyaningsih, Rio Christiawan (Bogor Agricultural University, Indonesia).....* A11-A16

Characteristics Composite Results Between Waste Rock and Coal Ash in Prevention Efforts Forming Acid Mine Water in Coal Mines

*By: Aida Syarif, M. Said, A. Halim PKS, Endang Wiwik (Politeknik Negeri Sriwijaya, Indonesia) .....* A15-A18

The Macroeconomic Model Consequences of Controlling Carbon Dioxide Emissions  
By: *Ida Febriana, Hilwatullisan (Politeknik Negeri Sriwijaya, Indonesia)*..... A19-A23

The Survival Ability of *Najasindica* Against The Heavy Metal of Lead (Pb)  
By: *Fadila Mutmainnah, Arinafril, Suheryanto (Widya Dharma Palembang, Indonesia and Sriwijaya University, Indonesia)*..... A25-A28

Potentiometric Sensor for Endosulfan Pesticide Based on Molecularly Imprinted Polymer  
By: *Yohandri Bow, Hairul, Ibnu Hajar (Politeknik Negeri Sriwijaya, Indonesia)*..... A29-A32

### **Sub Theme B – Biomass to Energy**

Liquid Waste of Palm Oil Plantations as Liquid Fertilizer  
By: *Elfidiyah (University of Muhammadiyah Palembang, Indonesia)*..... B1-B4

The Test Performance Filter Straw as Syngas Cleaner Media on The Appliance Biomass Gasification of Updraft Single Gas Electrical System  
By: *Zurohaina, Arizal Aswan, Dwi Arnoldi (Politeknik Negeri Sriwijaya, Palembang, Indonesia)*..... B5-B9

Biomass Gasification of Sugar Cane Single Gas Outlet Updraft System By Straw Filter Cleaning  
By: *Yuniar Zulkarnain, KA Ridwan, Fatria (Politeknik Negeri Sriwijaya, Indonesia)*..... B11-B14

Preparation and Characterization of Activated Carbon from Palm Shell  
By: *Husaini A, Susila Arita, Yazid M, Novita, R. Junaidi (Sriwijaya University, Indonesia and State of Polytechnic of Sriwijaya, Indonesia)*..... B15-B19

Charcoal Briquettes from Solid Waste of Crudepalm Oil Production as An Alternative Energy  
By: *Fatria, Siti Khodijah, Selastia Yuliati (Politeknik Negeri Sriwijaya, Indonesia)*..... B21-B24

Production of Cork Fish Bone Gelatin with Protein A-Casein Addtion  
By: *Endang Supraptiah, Idha Silviyati, Aisyah Suci Ningsih, Masayu Tsurroya (Politeknik Negeri Sriwijaya, Palembang, Indonesia)*..... B25-B29

Separation Process Biodiesel from Waste Cooking Oil using Ultrafiltration Membranes  
By: *Eka Sri Yusmartini, Rusdianasari (Muhammadiyah University, Palembang, Indonesia and Politeknik Negeri Sriwijaya, Palembang, Indonesia)*..... B31-B33

Lipid Extraction From Microalgae *Botryococcus Braunii* Using Maseration, Soxhlet, Percolation, Osmotic and Autoclave Method  
By: *Leila Kalsum, Indah Purnama Sari, Mega Silvia (Politeknik Negeri Sriwijaya, Palembang, Indonesia)* ..... B35-B41

### **Sub Theme C – Renewable Energy**

A Review on Environmental Impact of Wind Energy  
By: *Chan Sovannara, Firdaus, Rusdianasari (Industrial Technical Institute of Cambodia and Politeknik Negeri Sriwijaya, Palembang Indonesia)*..... C1-C6

Hybrid to Support Continuing Energy  
By: *Ali Kasim, Nina Paramytha IS (Bina Darma University, Indonesia)*..... C7-C12

The Effectiveness of Separation Hydrogen by Electromagnetic Forces to Efficiency Electrolysis of Water Combustion of Hydrogen  
By: *Ahmad Zikri, Lety Trisnaliani, Indah Purnamasari (Politeknik Negeri Sriwijaya, Indonesia)* ..... C13-C17

A Survey on Solar Cell; the Role of Solar Cell in Robotics and Robotics Application in Solar Cell Industry  
By: *Tresna Dewi, Pola Risma, Yurni Oktarina, M. Taufik Roseno, Hendra Marta Yudha, Ade Silvia Handayani, and Yudi Wijnarko (Politeknik Negeri Sriwijaya, Indonesia and Tridinanti University Palembang, Indonesia)*..... C19-C22

Photovoltaic Module Parameters Estimation using Fuzzy Logic Analysis  
By: *Helal Al-Hamadi (Computing Sciences and Engineering, Kuwait University, Kuwait)* ..... C23-C26

The Efficiency Decrement of The Spiral Pump Regarding the Pipe Coil Diameter  
By: *Darmawi, Riman Sipahutar, Jimmy D Nasution, Akhsani Taqwiym, Nurussama (Sriwijaya University Indonesia, STMIK – MDP Indonesia and Politeknik Palcomtech, Indonesia)*..... C27-C29

Utilization of Sea Wave As Power Plant with Piston  
By: *Almadora Anwar Sani, Widiyatmoko (Politeknik Negeri Sriwijaya, Indonesia and Polytechnic Sekayu, Indonesia)*..... C31-C39

### **Sub Theme D – Audit Energy**

Performance Coffee Bean Rotary Dryer to Efficiency and Specific Energy  
By: *Zulkarnain, Yuniar, Adi Syakdani (Politeknik Negeri Sriwijaya, Palembang, Indonesia)* ..... D1-D4

Calculation of Labor and Material Needs in Building and Housing Based on SNI 2008 using Microsoft Excel Macros  
By: *Eman Setiawan, Julistyana Tistogondo, Tony Hartono Bagio, Rouil Afaq (Universitas Narotama, Surabaya, Indonesia)*..... D5-D10

ICT and Eco Campus, Strategy for Reducing Energy Consumption in The Narotama University  
By: *Iswachyu Dhaniarti, M. Ikhsan Setiawan, Sri Wiwoho Mudjanarko, Ani Wulandari (Narotama University, Surabaya, Indonesia)* ..... D11-D13

Stable Channel of Reclaimed Tidal Lowland on Telang in Banyuasin District  
By: *Henggar Risa Destania, Achmad Syarifudin (Gadjahmada University, Yogyakarta, Indonesia and Bina Darma University, Indonesia)*..... D15-D18

### **Sub Theme E – Technology for Energy**

Renewable Energy: Advantages and Disadvantages  
By: *Reinhard Ploetz, Rusdianasari, and Eviliana (Environmental Ministry of Lower Saxony and the Regional Government of Hanover, Germany and Politeknik Negeri Sriwijaya, Indonesia)* ..... E1-E3

Automatic Irrigation System to See Dry Soil Condition Based Wireless Sensor Network  
By: *Eka Susanti, Rosita Ferbriani (Politeknik Negeri Sriwijaya, Indonesia)*..... E5-E7

Finger Tracking and Recognition using OpenCv Raspberry Pi 3  
By: *Alan Novi Tompunu, Meidyan Permata Putri, Lukmanul Hakim, Bahri Joni, Zamheri, Dedi Rusdiyanto (Politeknik Negeri Sriwijaya, STMIK Palcomtech, and Sriwijaya University, Indonesia)* ..... E9-E12

Design Printing Equipment Waste of Plastics Scale Household with Molding Injection Methode  
By: *Idha Silviati, Elina Margaretty, Hilwatulisan (Politeknik Negeri Sriwijaya, Indonesia)* ..... E13-E16

The Analysis of Coal Liquefaction with the Utilization of Limonite Catalyst on Central Banko, Tanjung Enim South Sumatera  
By: *Neny Rochyani, Conan Sumadi (PGRI University and SIGMA Informatic and Computer Academy, Palembang, Indonesia)* ..... E17-E20

Design of Induction Heating for Coal Liquefaction  
By: *Nova Rachmadona, Yohandri Bow, Arizal Aswan (Politeknik Negeri Sriwijaya, Indonesia)* ..... E21-E25

### **Sub Theme F – Design/Modelling**

Model Pavement Asphalt Roads by Use Waste Spon and Waste Tire  
By: *Dony Ilmy Idoma, Sri Wiwoho Mudjanarko (Narotama University, Surabaya, Indonesia)* ..... F1-F4

Hydrograph Performance of Bendung Watersheed in Palembang City  
By: *Achmad Syarifudin, Amirudin Syarif (Bina Darma University, Indonesia)*..... F5-F8

Designing a Sun Tracker on Maximum Energy Point by Fuzzy Logic  
By: *Ahyar Supani, Indarto, Yulian Mirza (Politeknik Negeri Sriwijaya, Palembang, Indonesia)* ..... F9-F15

Introduction of Interactive Application of Traditional Indonesian Musical Multiplatform Based on Smartphone  
By: *Hetty Meileni, Indra Satriadi, Nita Novita (Politeknik Negeri Sriwijaya, Palembang, Indonesia)* ..... F17-F20

Unmanned Aerial Vehicles for Pioneer Forest Fire Monitoring  
By: *Nyayu Latifah Husni, Ade Silvia Handayani, Masayu Annisah, DewiPermata Sari(Politeknik Negeri Sriwijaya, Indonesia)* ..... F21-F26

Analysis Intrusion Prevention System (IPS) on Computer Networking  
By: *Tamsir Ariyadi, Aan Restu Mukti (Bina Darma University, Indonesia)*..... F27-F31

Automatic Control System Palembang Songket Shawl Based ATmega 32  
By: *Sholihin, Siswandi (Politeknik Negeri Sriwijaya, Indonesia)*..... F33-F37

|  |         |
|--|---------|
| Application Data Processing Development Facilities and Assets using Web Based System Development Life Cycle Method at The State Polytechnic of Sriwijaya<br>By: <i>Sony Oktapriandi (Politeknik Negeri Sriwijaya, Indonesia)</i> .....   | F39-F42 |
| 6LowPan and IEEE 802.15.4 for Personal Area Network<br>By: <i>Horst Schwetlick, Sopian Soim, Ciksadan (SES formerly HTW-Berlin, Germany and Politeknik Negeri Sriwijaya, Palembang, Indonesia)</i> .....   | F43-F45 |
| Technology Model Precast Foundation for Eco-Friendly Solution<br>By: <i>Koespiadi, Fredy Kurniwan, Gede Arimbawa, Sri Wiwoho Mudjanarko, Nawir Rasidi (Narotama University, Surabaya, Indonesia and Polinema Malang, Indonesia)</i> .....  | F37-F40 |
| Yagi Antenna Design to Reinforce The 2,4 GHz Wifi Signal Reception Using Android<br>By: <i>Suzanzefi, Rapiko Duri (Politeknik Negeri Sriwijaya, Palembang, Indonesia)</i> .....  | F41-F44 |
| Simulation of Mobile Station Antenna Height Factor Effect Againts the Path Loss in A Variaety of Mobile Propagation Models<br>By: <i>Martinus Mujur Rose (Politeknik Negeri Sriwijaya, Palembang, Indonesia)</i> .....   | F45-F51 |
| Detector Color and Nominal Money System for Blind Based Arduino<br>By: <i>Ibnu Ziad, Widya Hurisantri (Politeknik Negeri Sriwijaya, Palembang, Indonesia)</i> .....  | F53-F64 |
| Nazief and Adriani's Stemming Algorithm Implementation on Indonesian Scientific Writing Error Identification and Correction Software<br>By: <i>Sunda Ariana, Hadi Syaputra, Margareta Andriani, Suheriyatmono (Bina Darma University, Indonesia)</i> .....   | F65-F68 |
| Design Robot Arm Movement Followers Fingered Man using a Flex Sensor with a Microcontroller System ATMega 32<br>By: <i>Oulad Daoud Yousra, Selamat Muslimin, Yudi Wijanarko (Universite de Science et Technologie de Houarie Boumediene (USTHB), Algeria and Politeknik Negeri Sriwijaya, Indonesia)</i> ..... | F69-F75 |
| Battery Safety System in Energy Load Usage of Electric Car<br>By: <i>Ahmad Hafiz Wijanarko, Selamat Muslimin, Ekawati Prihatini (Politeknik Negeri Sriwijaya, Indonesia)</i> .....   | F77-F83 |



## **Sub Theme G – Economic Sustainability**

- Analysis of Demand of CPO as Alternative Energy to Employment and Gross Domestic Product in South Sumatra  
*By: M. Yusuf (Politeknik Negeri Sriwijaya, Indonesia) ..... G1-G4*
- Intellectual Capital and Return on Investment: in Mining Companies  
*By: Rita Martini, Sulaiman, L. Vera Riama, Kartika Rachma Sari, Maria, Hanina Sari (Politeknik Negeri Sriwijaya, Palembang, Indonesia)..... G5-G10*
- Relative Price in The Demand for Indonesian Narrow Money  
*By: Delta Khairunnisa (Politeknik Negeri Sriwijaya, Indonesia) ..... G11-G16*
- The Impact of Management Accounting Information System and Environmental Uncertainty on The Quality of Management Accounting Information  
*By: Lambok Vera Pangaribuan (Politeknik Negeri Sriwijaya, Palembang, Indonesia) ..... G17-G22*

## **Sub Theme H – Management**

- Data Governance in The Renewable Energy Development: Issues and Challenges  
*By: Sonny Zuhuda (International Islamic University Malaysia, Kuala Lumpur, Malaysia)..... H1-H5*
- Developing Students' Mathematical Communication Ability Through Performance Assessment on Derrivative Topic  
*By: Muhammad Isa, Burhanuddin AG (University of Seramb Miekkaha, Banda Aceh, Indonesia) ..... H7-H13*
- Household Consumption Patterns of Production Workers, Operators, and Blue-Collar Workers in Palembang, South SUMatera  
*By: Neneng Miskiyah, Taufiq, Tatang A.M. Sariman, Rosmiyati Chodijah (Politeknik Negeri Sriwijaya, Indonesia)..... H15-H21*
- Case Study Factors That Influence Children to Workers Kalidoni Village in Palembang  
*By: Indri Ariyanti, Rika Sadariawati, M. Noval (Politeknik Negeri Sriwijaya, Indonesia) ..... H23-H26*
- The Analysis of Intellectual Capital and Working Environment on Lecturers Work Commitment  
*By: L. Suhairi Hazisma, Lambok Vera Riama Pangaribuan (Politeknik Negeri Sriwijaya, Indonesia) ..... H27-H31*

- The Development of Long Apung Airport as The Central of Economic in The Border Region with The Support of Regional Renewable Energy  
By: *M. Ikhsan Setiawan, Sri Wiwoho Mudjanarko, Ronny D Nasihien, Edy Santosa (Narotama University, Surabaya, Indonesia)* ..... H33-H35
- The Development of Integrated Maritime Industrial and SME's Area in North Madura with The Support of Renewable Energy  
By: *Sri Wiwoho Mudjanarko, Reswanda T. Ade, M. Ikhsan Setiawan, Slamet Winardi (Narotama University, Surabaya, Indonesia)* ..... H37-H39
- The Role of State Translator in Enhancing the Development of Vocational Education to Meet The Global Labour Market  
By: *Eviliana, Ahmad Taqwa, and Zulkarnaini (Politeknik Negeri Sriwijaya, Indonesia)* ..... H41-H44
- Determinants of Job Satisfaction and Its Implication on The Performance of Lecturers in State Universities in South Sumatra  
By: *Periansya (Politeknik Negeri Sriwijaya, Palembang, Indonesia)*..... H45-H55
- Determinants of The Improvement of Employees' Performance  
By: *Hadi Jauhari and Evada Dewata (Politeknik Negeri Sriwijaya, Indonesia)*..... H57-H64
- Information System of Urban Public Transport in The City of Palembang  
By: *Shafira Rianesti Noor, Leni Novianti, Dedy Rusdyanto, Rika Sadariawati (Politeknik Negeri Sriwijaya, Palembang, Indonesia)*..... H65-H69

## **EDITORIAL BOARD**

### **Editors:**

**Dr. Rusdianasari (Indonesia)**  
**Dr. Eng. TresnaDewi, M.Eng. (Indonesia)**  
**Prof. Ir. SubriyerNasir, M.Sc., Ph.D (Indonesia)**  
**Prof. Dr. Werner Rammensee (Germany)**  
**Prof. ErryYulianTriblasAdesta, Ph.D (Malaysia)**  
**Dr. Sonny Zulhuda (Malaysia)**

## REMARKS FROM DIRECTOR



AssalamualaikumWaRahmatullahiWaBrakaturuh,  
In the Name of Allah, the Most Beneficent, the Most Merciful  
May the peace, the mercy, and the blessing of Allah be upon you.

Distinguished Participants, Ladies and Gentlemen,  
On the behalf of State Polytechnic of Sriwijaya, I would like to welcome you all to the  
International Conference FIRST 2016 on Renewable Energy for Sustainable  
Development

Forum in Research, Science, and Technology(FIRST)is a meeting organised to accomodate researchers, academics, businessman, and government to follow up research results, to identify industry needs and to keep updated with the government policies. This forum has moved from national scale into an international conference which is conducted annually by State Polytechnic of Sriwijaya. This year, FIRST brings a theme “Renewable Energy for Sustainable Development”. It is realised that efforts to solve environmental problems that we are facing today need long term potential actions for sustainable development; And renewable energy resources is one of the most appropriate solutions. Therefore discussing about renewable energy automatically deals with sustainable development.

All papers presented in the conference are documented in proceedings. The proceeding features 71 papers divided into several fields including Environment, Biomass to Energy, Renewable Energy, Audit Energy, Technology for Energy, Design/Modelling, Economic Sustainability and Management. In brief, the relations between renewable energy and sustainable development are described with practical cases and several issues relating to renewable energy, environment and sustainable development from both current and future perspectives.

Our thanks are conveyed to the Governor of South Sumaterafor providing us direction and views related to the importance of renewable energy resources. Also appreciation and gratitude to the keynote speakers, H. Alex Nurdin, Governor of South Sumatera Province, Prof. TjandraSetiadi, Ph.D., ITB, Indonesia, and Prof. Dr. Werner Rammensee, Cologne University, Germany. Also to invited speakers,Prof. Dr. ErryYulianTriblasAdesta, International Islamic University, Malaysia, Christian Overfeld, Lucas Nuelle, Germany, Dr. Sonny Zuhuda, International Islamic University, Malaysia,Ir. Tri Mumpuni, Kementerian ESDM dan IBEKA, Indonesia, Ir. Fahrurrozi, M.Si., Business Head Chemicals Group, PT. BASF Indonesia and Head of Business Development, FederasiIndustri Kimia Indonesia ontheirpresentation related to renewable energy for sustainable development.

Further we extend deepest gratitude and high appreciation to all presenters and contributors to make this conference possible and these proceedings published. It is realised that publication of these proceedings are still far from being perfect; however, hopefully it will be useful for energy scientist, engineers, policy makers and any other readers as references for enriching their knowledge .

May God bless us all with the health to make this event a successful and enjoyable one!

Thank you.

Dr. Ing. Ahmad Taqwa, M.T.  
Director of State Polytechnic of Sriwijaya

## MESSAGE FROM THE CHAIRMAN

BISMILLAHIROHMANIRROHIM,  
ASSALAMUALAIKUM WW.,  
Good Morning Everyone  
May the peace, the mercy, and the blessing of Allah be upon you.

**The honorable governor of South Sumatra Province, Bapak H. Alex Noerdin**  
**The honorable Director of State Polytechnic of Sriwijaya, Bapak Dr. Ahmad**  
**Taqwa**  
**Distinguishedspeakers, Presenter, Guests, and Participants,**

It is my great pleasure to welcome and thank you very much for your contributions to this renewable energy conference. This conference which will take place on 18 up to 19 of October 2016, is conducted firstly this year through the initiation of Chemical Engineering Department, State Polytechnic of Sriwijaya, aims to exchange the ideas from governments, non-governmental organizations, research and academic institutions, international organizations, and industries, to learn from each other and build on successes that advance renewable energy for sustainable development.

I am very happy to inform that the committee is very lucky to have 3 keynote speakers, i.e Bapak H. Alex Noerdin, the governor of SS province, Prof. Chandra Setiady from ITB Bandung and Prof Werner Ramensee from Cologne University of Germany, who supported us from the very beginning with their capabilities to present, sharing knowledge and experiences with us here as well as the invited speaker i.e Prof. Dr. Erry Yulian Triblas Adesta, International Islamic University, Malaysia, Christian Overfeld, Lucas Nuelle, Germany, Dr. Sonny Zuhuda, International Islamic University, Malaysia, Ir. Tri Mumpuni, Kementerian ESDM dan IBEKA, Indonesia, Ir. Fahrurrozi, M.Si., Business Head Chemicals Group, PT. BASF Indonesia and Head of Business Development, Federasi Industri Kimia Indonesia.

**Distinguished Guests, Presenter, and Participants,**

On this special occasion, I would like to report that the conference manage to succesfully attract more than 71 academician to present their abstract, i.e from Kuwait, Germany, Algeria, Malaysia, Cambodia and of course Indonesia. Amongst others there 69 abstract to be presented in this seminar under professional selective review. And for that reason, I personally would congratulate you all as distinguished speaker to this event.

This conference has collaborated with two international journal i.e Journal of Engineering and Technological Science, ITB and Gadjah Mada International Journal of Business. All selected papers are then peer-reviewed to meet the publication standard. The peer reviewer of each manuscript is rigorous and concentrates on objective and technical concern to determine whether the research has been sufficiently well conceived, executed and described.

**Excellencies, Distinguished Guests, Ladies And Gentlemen**

I would also like to give special welcome to Lucas Nuelle, PT. Merck Chemicals and Life Sciences, CV. BestariSetiaAbadi, PT. BangunEnergi, PT. Ditek Jaya, PT. Bank MandiriTbk., PT. Indofood SuksesMakmur and individual who support this conference through sponsorship. I believe that we could never thank you enough for that.

Finally, I expect all participants have memorable moment through this conference and enjoy your stay in Palembang, South Sumatra Province, Indonesia. Thank you.

Sincerely  
Chairman of Organizing Committee  
H. Firdaus

## KEYNOTE SPEAKER



H. Alex Noerdin  
Governor of South Sumatera



Prof. Tjandra Setiady, Ph.D  
ITB, Indonesia



Prof. Dr. Werner Rammense  
Cologne University, Germany



## INVITED SPEAKER



**Prof. Dr. Erry Yulian Triblas Adesta**  
International Islamic University,  
Malaysia



**Christian Overfeld**  
Lucas Nuelle, Germany



**Dr. Sonny Zuhuda**  
International Islamic University,  
Malaysia



**Ir. Tri Mumpuni**  
Kementerian ESDM dan IBEKA,  
Indonesia



**Ir. Fahrurrozi, M.Si.**  
Business Head Chemicals Group, PT.  
BASF Indonesia and Head of Business  
Development, Federasi Industri Kimia  
Indonesia

### SCIENTIFIC COMMITTEE

1. Prof. Dr. Erry Yulian Triblas Adesta, IPM., Ceng., MIMechE  
IIUM, Malaysia
2. Prof. Dr. Werner Rammensee  
Cologne University, Germany
3. Dr. Sonny Zulhuda  
IIUM, Malaysia
4. Prof. Ir. Subriyer Nasir, M. Sc., Ph.D  
Universitas Sriwijaya, Indonesia
5. Prof. Dr. Hj. Badia Perizade, MBA  
Universitas Sriwijaya, Indonesia
6. Dr. Ali Ridho Baragbah  
Politeknik Elektronika Negeri Surabaya, Indonesia
7. Dr. Ismet Ilyas  
Politeknik Manufaktur Negeri Bandung, Indonesia
8. Dr. Ing. Ahmad Taqwa, M.T.  
Politeknik Negeri Sriwijaya Palembang, Indonesia
9. Dr. Eng. Tresna Dewi, S.T., M. Eng.  
Politeknik Negeri Sriwijaya Palembang, Indonesia
10. Dr. Ir. Rusdianasari, M. Si.  
Politeknik Negeri Sriwijaya Palembang, Indonesia
11. Dr. Ir. Abu Hasan, M. Si.  
Politeknik Negeri Sriwijaya Palembang, Indonesia
12. M. Yusuf, S.E., M. Si., Ph.D  
Politeknik Negeri Sriwijaya Palembang, Indonesia
13. Dr. Ir. Leila Kalsum, M.T.  
Politeknik Negeri Sriwijaya Palembang, Indonesia

## **ORGANIZING COMMITTEE**

- Advisory Board** : 1. Dr. Ing. Ahmad Taqwa, M.T.  
2. Carlos RS. S.T., M.T.  
3. Ir. IrawanRusnadi, M.T  
4. Drs. Zakaria, M.Pd  
5. Dr. Ir. Leila Kalsum, M.T
- Chairman** : H. Firdaus, S.T., M.T.
- Vice Chairman** : 1. Ir. Jaksen, M.Si  
2. AhyarSupani, S.T., M.T.
- Administrator** : 1. Firdaus, S.E., MM.  
2. HariMulyono, S.E., MM.
- Secretary** : Dr. Ir. Rusdianasari, M.Si
- Vice Secretary** : Eviliana, S.Pd
- Treasurer** : Yuniar, S.T., M.Si.
- Vice Treasurer** : LetyTrisnaliani, S.T., M.T.

### **Committee Members**

1. Ir. Zulkarnaini., M.T
2. Dr. Martha Aznuri, M.Si
3. Dr. Eng. TresnaDewi, M.Eng
4. M. Yusuf, S.E., M.Si., Ph.D
5. M. Miftakul Amin, S.Kom., M.Eng
6. Drs. MochamadAbsor, M.T
7. Dr. Ir. Abu Hasan, M.Si
8. Ir. SelastiaYuliati, M.Si
9. Zurohaina, S.T., M.T
10. Ir. AisyahSuciNingsih, M.T
11. Indah Purnamasari, S.T., M.Eng.
12. Suyanto
13. Baheramsyah
14. Prandoko
15. Hermanto

# CHARACTERISTICS COMPOSITE RESULTS BETWEEN WASTE ROCK AND COAL ASH IN PREVENTION EFFORTS FORMING ACID MINE WATER IN COAL MINES

Aida Syarif <sup>1)</sup>, M.Said <sup>2)</sup>, A. Halim PKS <sup>3)</sup>, EndangWiwik <sup>4)</sup>

<sup>1,2,3,4)</sup> *Politeknik Negeri Sriwijaya, Jl. Sriwijaya Negara, Palembang, 30139*

*E-mail :aida\_syarifyahoo.co.id*

*University of Sriwijaya, Jl. Sriwijaya Negara, Palembang, 30139*

*E-mail: saidm\_19@yahoo.com, halimpks@gmail.com, endanghastuti@gmail.com*

**Abstract.** Acid mine drainage (AAT) is the environmental impact arising from a process of coal mining operations. The formation affected by acid mine drainage and terhidrolisisnya oxidized pyrite content in the waste rock. The existence of this AAT negatively affecting the environment in which the lead increasing soil acidity, lowering the pH of the soil and water can corrode the mining process tool. In AAT prevention efforts done them with prevention and treatment. In the method of prevention can be done in an effort to avoid one of the AAT-forming factor is whether the process of oxidation or hydrolysis. The results of the sample characteristics can be stated that the 4 samples declared as rock acid-forming potential as to sample A, B, C and D and sample E as Uncertain. From the results of the study of the use of coal ash as material waste rock neutralizing potential sources of forming AAT then the result is that coal ash can prevent the formation of AAT. This test is done by layering and blending coal ash dumping ground further tested by flowing water into the material and can do analysis the results of leachate pH, content of metal (Fe, Mn and Al). The analysis results showed that the pH of the leachate in each test ranged 6-7, the metal content of Fe, Mn and SO<sub>4</sub> respectively 1.8 -0.1, 6 – 1,2 dan 0.9 -0.1

*Keywords- waste rock, ash coal, and composite*

## I. INTRODUCTION

Coal is one of the sources of energy that is important to the world, which is used in generators plant to produce power nearly 40% in the whole world. In many countries these figures are much higher: Poland uses more than 94% for the power plant, South Africa 92%; China 77%; and Australia 76%. Coal is a source of energy that experienced a growth that most rapidly in the world in recent years - faster than gas, oil, nuclear, water, and replacement resources.

In Industrial world record says that in 2009-2010, Indonesia is thesecond-largest coal exporter in the world, after Australia. Coal is needed for the power plant and a source of industrial fuel. Indonesian coal resources in 2011 is about 105,187.44 million tons with total coal reserve about 21,131.84 million tons, with the coal resource and reserve distributing area including 52,482.20 million tons in Sumatra, 52,326.23 million tons in Kalimantan, 233.10 million tons in Sulawesi, 128.57 million tons in Papua, 14.21 million tons in Java, and 2.13 million tons in Maluku. Coal production in 2005 is about 152,325.025 Ton with export capacity 93,758.806 Ton, the import 97,183 tons and domestic needs 36,081,734 Ton, at the end of 2011, the production increased to 353,383,341 tons.(sourceBadan Geologi, Kementrian ESDM 2011)

The relation between mining activities and environmental issues has always been a hot issue today. One of the concerns is the water pollution caused by mining activities, such as Acid Mine Drainage/ (AMD).Acid mine is runoff water which is caused from

oxidation reactions rocks or soil containing pyrite (FeS<sub>2</sub>), or other produce sulfide with oxygen even oxygen from the air or in water. And also accompanied by hydrolysis reaction from rain or ground water in mine (Elberinget,al 2008).The problems caused by the water acid mine is one of the environmental impact on the mining industry. Water acid is usually characterize with the low pH, high content of heavy metals (Fe), aluminum (Al), manganese (Mn) in the water, and the water which are yellow. Acid mine drainage treatment needs to be done it aims to maintain the environmental conditions in the coal mining area so as to realize sustainable mining system in accordance with the Environment laws.

There are two methods that can be used in treatments acid mine drainage is by the method of prevention and treatment.

Methods of prevention can be done by isolating the source of acid mine drainage as acid rock with materials such as soil, water, whereas the method of treatment can be done with chemical and biological processes.

In this study will be assessed on a method of preventing the formation of acid mine drainage with the composite method of acid rock and coal ash.

## II. RESEARCH METHOD

This research was conducted inthe laboratory Polytechnic of Sriwijaya, Department of Chemical and Energy Engineering and Laboratory Coal Mining of PTBA, TanjungEnim, Which begin with rocksamplingprocess, sample andequipment preparation, testingandanalysis.

Samples of rocks taken from waste rock coal mine in South Sumatra as many as five samples at the disposal dump area by taking samples at some point ordinate can be seen in Table 1.

TABLE I  
CODE SAMPLES

| No | Listing Samples | X       | Y        |
|----|-----------------|---------|----------|
| 1  | A               | 362257E | 9589795N |
| 2  | B               | 362285E | 9589817N |
| 3  | C               | 363205E | 9590045N |
| 4  | D               | 363305E | 9589772N |
| 5  | E               | 365800E | 9589635N |

Source: primary data December 2013

A. Tools and Materials.

1. Tool  
The tool used in, balance sheet analytical, pH meters, Leached coulums, AAS
2. Material  
Materials used waste rock coal miners, ferrous sulphate, aquades, fly ash, manganese sulphate.

B. The Procedure

1. Preparation
  - a. The sample acid rock preparation is done with the process of size reduction of 60 # and characterized
  - b. Rocks that are acid-forming potential of rocks used as a test sample for the prevention of the formation of acid mine drainage by conducting composite with coal ash
2. Research procedure
  1. The rocks are characterized as acid rock made of composite process with coal ash with a ratio of 20%, 40% and 60%
  2. Each of these composites included in the column leachate
  3. Each composite purged with distilled water.
  4. further characterization of the leachate in pH, contents ions Fe, Mg, sulphates and TSS
  5. Repeat steps 3 every day until a neutral pH

III. RESULTS and DISCUSSION

A. Result

1. Result of Characteristics Rock

Results from static tests is a reference to determine classification of a sample rocks. Based on the result of the test static in a laboratory, is as follows: each sample test result can be seen in Table III

Rock classification method based on a static test can be done by using a different interpretation. One of

the classifications is done by categorizing the sample with classification NAPP and NPR values (neutralization Potential Ratio = ANC / MPA)

TABLE II  
MATERIAL CLASSIFICATION

|         | Potentially Acid Forming (PAF) | Uncertain Zone | Non-Acid Forming |
|---------|--------------------------------|----------------|------------------|
| ANC/MPA | <1                             | 1-2            | >2               |

Source: (AMD Book 2002)

TABLE III  
DATA ANALYSIS RESULTS SAMPLES ROCKS of STATIC TEST

| No | Kodes sampel | Parameter |  |   |                     |  |
|----|--------------|-----------|--|---|---------------------|--|
|    |              | TS (%)    | MPA/PKM Kg H <sub>2</sub> SO <sub>4</sub> /ton | ANC/K PA Kg H <sub>2</sub> SO <sub>4</sub> /ton | ANC /MP A KPA /PK M | NAPP/PPAN Kg H <sub>2</sub> SO <sub>4</sub> /ton |
| 1  | A            | 0.90      | 27.56  | 5.08  | 0.18                | 22.48  |
| 2  | B            | 2.42      | 74.11  | -10.28  | -                   | 84.39  |
| 3  | C            | 0.76      | 23.28  | 9.46  | 0.41                | 13.82  |
| 4  | D            | 0.79      | 24.19  | 12.86   | 0.53                | 11.33  |
| 5  | E            | 0.21      | 6.43   | 15.65   | 2.43                | -9.22  |

| No | code sampel | Parameter |             |   |   |
|----|-------------|-----------|-------------|---|---|
|    |             | pH PAST A | NAG/PA N pH | NAG/PAN                                       |   |
|    |             |           |             | pH 4.5 Kg H <sub>2</sub> SO <sub>4</sub> /ton | pH 7.0 Kg H <sub>2</sub> SO <sub>4</sub> /ton |
| 1  | A           | 3.66      | 3.11        | 17.15   | 35.10   |
| 2  | B           | 2.62      | 2.94        | 22.34   | 34.30   |
| 3  | C           | 3.48      | 3.20        | 10.37   | 24.73   |
| 4  | D           | 6.90      | 3.06        | 11.17   | 21.14   |
| 5  | E           | 3.41      | 4.32        | 0.40  | 6.78  |

Source: primary data (2013)

The results of the sample characteristics can be stated that the 4 samples declared as rock acid-forming potential as to sample A, B, C and D and sample E as Uncertain.

Further samples A and B used as the test sample composites with coal ash

2. Result of characteristics each Composites leachate

The characteristic of each composite leachate can be seen on Fig 1. until Fig,5 .

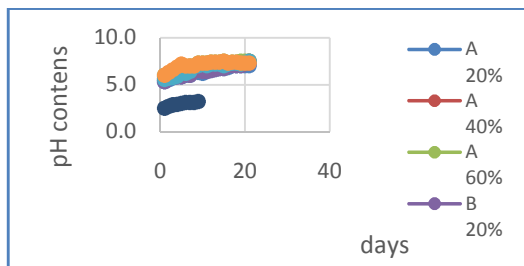


Fig.1. The graph Characteristic pH Vs time for each leachates

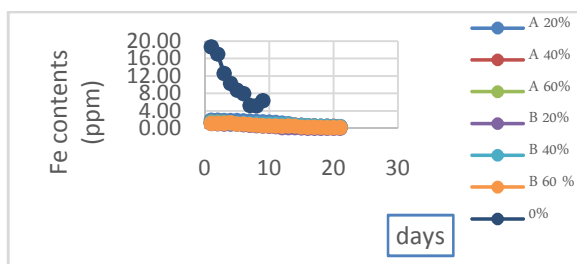


Fig.2. The graph Characteristic ions Fe Vs time for each leachates

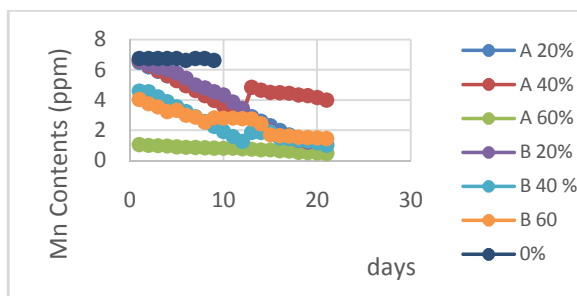


Fig.3. The graph Characteristic ions Mn Vs time for each leachates

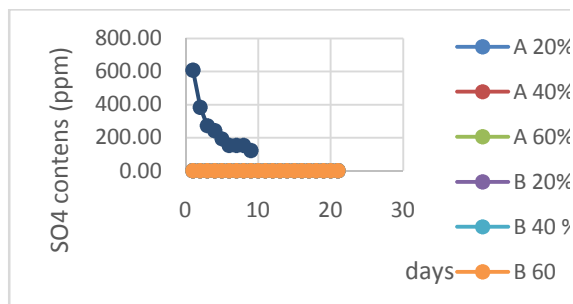


Fig.4. The graph Characteristic ions Mn Vs time for each leachates

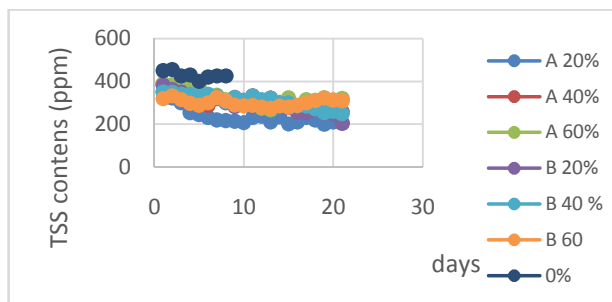
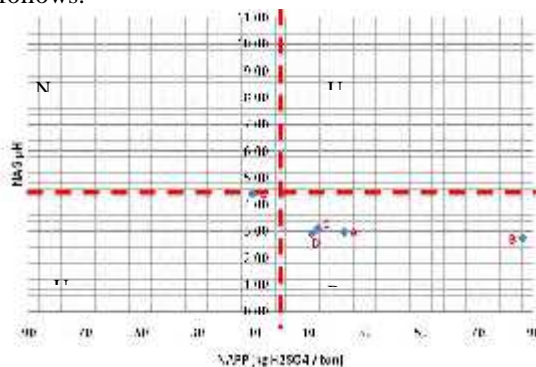


Fig.5. The graph Characteristic ions Fe Vs time for each leachates

B. Discussion

1. Acid Base Accounting, (ABA)

Based on data from the test result static analysis geochemistry rocks with the ABA method, data in hatching according to analysis methods Graphics on the basis the ratio SPOKES/MPA, NAPP and NAG pH is as follows:



Source: primary Data 2013  
Fig.6 Analysis of rocks Based Graphics

From results graph in the picture 6 then, that the result characteristic geochemical analysis to 5 (five) samples of rocks obtained 4 samples are samples had A,B,C and D include intorocksclass with type PAF and a sample E that include class uncertain (UC), in detail can be seen in table III result of types of rock samples with test static. Samples advanced this will be tested kinetic and in test major justification would be with ash coal.

TABLE VI  
RESULT OF CLASIFICATION SAMPLES  
ACID ROCK

| No | Listing | Classification |
|----|---------|----------------|
| 1  | A       | PAF            |
| 2  | B       | PAF            |
| 3  | C       | PAF            |

|   |   |         |
|---|---|---------|
| 4 | D | PAF     |
| 5 | E | UC(PAF) |

According to analysis of types of material acid above, from the five samples that has been tested static, it can be said that the samples that PAF strong, 3 samples include PAF are, and a sample *uncertain PAF*. The sample take for analysis study of composite 2 sample ei sample A and B.

## 2. The Characteristic Leachates Composite

Characteristic Leachate from each Composite can be seen from Figures 1 to 5 on the pH value, ions Fe, Mn, SO<sub>4</sub> and TSS.

The results for the characteristics of the pH value of each of the composite state that the increase in the pH value is affected by the composite.

The content of Fe ions in the leachate decreased balanced by compositing and long time.

The content of sulfate ions is very small for each composite are also against long time.

The content of TSS is not affected by the composite and the length of time it is in because TSS is caused by fine particles in the leachate breakouts mitigation process can be carried out physically by way of deposition and fitrasi.

## C. Conclusion

From the result of the research, it had taken some conclusions:

1. Coal ash (fly ash) can be used as a material in the process of prevention of the formation of acid mine drainage by means of composite between waste rock and coal ash.
2. Composite affect the value characteristics of the leachate to the pH value, the content of metal ions Fe, Mn, sulfate ions .

## ACKNOWLEDGMENT

Author thanks for Head Laboratory and staff of Laboratory Polytechnic of Sriwijaya Department Chemical Engineering and Energy and the Head Laboratory PTBA on support for Research and analysis

## REFERENCES

- [1] Aida, S, 2014, Characterization of Geochemical Disposal on Indicate and Mitigation Acid mine drainage formation at Coal Mining Bukit Asam Tanjung Enim IJASEIT, (International Journal of Advanced Science engineering Information Tecnology ) ISSN : 2088-5334, Vol 4, N.3, 2014 P, .....
- [2] Benzaazoua, M, Bussie 're, B, A.M, Dagenais, Archambault (2004), Kinetics Tests Comarissons and Interpretation for Prediction of the Joutel tailings Acid Generation potential, Journal of Environmental Geology 1086-101

- [3] Hessley, R. K., Reasoner J. W. (1986),, and Riley J. T. , *Coal Science*, John Wiley and Sons, New York, 81 - 87
- [4] *Journal of Nuclear Science and Technology*, 2001, Vol. 38, No. 9, p. 766-772
- [5] Honmberger, R, Brady, Chapter 5, Static Test for the Prediction of Mine drainage Quality, *The Department of environmental Protection : Puttsville*
- [6] Rose, Arthur W, Cravotta, Chapter 1: geochemistry, of Coal Mine Drainage *Department of Geoscience, Pen State University*
- [7] Tear, A, Schuler, Freeman W. J and Smith, R (1978) Field and Laboratory methods Applicable to overburdens and minesoils, ( Virginia Morgantown Udayana University College of agriculture and forestry) economic partnership agreement (EPA) - 600/7-2-054, P-47.50
- [8] \_\_\_\_\_1997 , Timika Enviromental Laboratory, PT Freeport Indonesia Test Method- Acid Neutralising Capacity
- [9] Smart, Roger, (2002), HIGH Test handbook: Project P387A Predection& Kinetic Control Acid Mine Drainage , *Melbourne Australia: AMIRA International Limited*
- [10] U.S, Enviromental Protection Agency (EPA) (2009), Static Test and Kinetic Test Methodes for Prediction of Mine Drainage Quality,



Forum in Research, Science and Technology  
International Conference



# CERTIFICATE

This is to certify that

**Aida Syarif**

as

**Author**

International Conference FIRST 2016

**Renewable Energy for Sustainable Development**

Held on October 18-19, 2016  
State Polytechnic of Sriwijaya  
Palembang, Indonesia

Chairman of the Committee



H. Firdaus, S.T., M.T.

Director of  
State Polytechnic of Sriwijaya



Dr. Ing. Ahmad Taqwa, M.T.

