

# 2018 7th International Conference on Environment, Energy and Biotechnology (ICEEB 2018)

**Kitahiroshima, Japan**

**August 27-29, 2018**



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# 2018 HKCBEEES Kitahiroshima Conference Introductions

Welcome to HKCBEEES 2018 conference in Seisa Dohto University, Kitahiroshima, Japan. The objective of the Kitahiroshima conference is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in Environment, Energy and Biotechnology.

**2018 7th International Conference on Environment, Energy and Biotechnology  
(ICEEB 2018)**

\* **Paper publishing and index:** **ICEEB 2018** papers will be published in the following Journal:



**International Journal of Smart Grid and Clean Energy (IJSGCE, ISSN: 2315-4462, DOI: 10.12720/sgce)**, and will be included in EI (INSPEC, IET), SCOPUS, DOAJ, Ulrich's Periodicals Directory, Google Scholar, Crossref, etc.

\* **Conference website and email:** <http://www.iceeb.org/>; [iceeb@cbees.org](mailto:iceeb@cbees.org).

# Conference Venue

## Seisa Dohto University

149 Nakanosawa, Kitahiroshima-shi, Hokkaidō 061-1101  
(〒061-1196 北海道北広島市中の沢 149 番地)

The university stands in Kitahiroshima City in Hokkaido where is the Northern part of Japan. Kitahiroshima city is located midway between Sapporo, the capital of Hokkaido, and Chitose City, the seat of New Chitose International Airport.

Kitahiroshima City has been chosen as the most livable town within Hokkaido in the past three years for the sake of its convenience accesses to the biggest city in Hokkaido, Sapporo, and the airport in addition to its good balance of nature in a living environment.

### Access Guide



#### By Train

16 minutes from JR Sapporo Station. 7 minutes from JR Shin Sapporo Station. 20 minutes from JR New Chitose Airport Station.

#### By Bus

7 minutes from JR Kitahiroshima Station (Free shuttle bus services available during the school terms).

30 minutes from Toho Subway Line Fukuzumi Station.

## Detailed Schedule for Conference

<b>Day 1</b>	<p><b>August 27, 2018 (Monday) 10:00~17:00</b>  <b>Venue: Building 3, First Floor, Entrance Hall of Seisa Dohto University</b>          Participants Onsite Registration &amp; Conference Materials Collection</p>
<b>Day 2</b>	<p><b>August 28, 2018 (Tuesday) 9:00~17:30</b>  <b>Venue: 3201 &amp; 3202 (Building 3, Second Floor)</b>          Arrival Registration, Keynote Speeches, and Conference Presentations</p>
	<p><b>Morning Conference</b>  <b>Venue: 3201 (Building 3, Second Floor)</b></p>
	<p><b>Opening Speech 9:00~9:05</b>          Prof. Seiro Masaki from Seisa Dhoto University, Japan</p>
	<p><b>Keynote Speech I 9:05~9:40</b>          (Prof. Wallace C.H. Choy from Hong Kong University, Hong Hong)          Topic: “Highly Stable and Efficient Thin-Film Photovoltaic Devices”</p>
	<p><b>Keynote Speech II 9:40~10:15</b>          (Prof. Miwako Hosoda from Seisa University, Tokyo, Japan)          Topic: “Protecting the Natural Environment and Creating a Harmony          Between Nature and Human-beings”</p>
	<p><b>Coffee Break &amp; Photo Taking 10:15~10:45</b></p>
	<p><b>Keynote Speech III 10:45~11:20</b>          (Prof. Kokyo Oh from Center for Environmental Science in Saitama,          Japan)          Topic: “Contamination of Agricultural Soils and its Conservation with          Phytoremediation technology”</p>
	<p><b>Keynote Speech IV 11:20~11:55</b>          (Prof. Chan Jin Park from Incheon National University, Republic of          Korea)          Topic: “On the Policy of Global Warming Countermeasures to Cope          with Convention on Climate Change”</p>
	<p><b>Lunch 11:55~13:00</b>  <b>Venue: 3201 (Building 3, Second Floor)</b></p>

<b>Afternoon Conference</b>	
<p><b>Session 1: 13:00~15:00</b>  <b>Venue: 3201 (Building 3, Second Floor)</b>            Session Chair: Prof. Wallace C.H. Choy            8 presentations-Topic: “Power and Energy Engineering”</p>	<p><b>Session 2: 13:00~15:00</b>  <b>Venue: 3202 (Building 3, Second Floor)</b>            Session Chair: Prof. Kokyo Oh            8 presentations-Topic: “Environmental Engineering and Biological Science”</p>
<b>Coffee Break 15:00~15:15</b>	
<p><b>Session 3: 15:15~17:30</b>  <b>Venue: 3201 (Building 3, Second Floor)</b>            Session Chair: Prof. Miwako Hosoda            9 presentations-Topic: “Environmental Engineering and Biological Science”</p>	
<p><b>Poster (9:00~17:30)</b>            9 poster presentation</p>	
<p><b>Dinner:18:00</b>  <b>Venue: Restaurant of Sapporo Kitahiroshima Classe Hotel</b></p>	
<b>Day 3</b>	<p><b>August 29, 2018 (Wednesday) 9:00~17:00</b>  <b>One Day Visit</b></p>

**Note:** (1) The registration can also be done at any time during the conference.

(2) The organizer doesn't provide accommodation, and we suggest you make an early reservation.

(3) One best oral presentation will be selected from each oral presentation session, and the Certificate for Best Oral Presentation will be awarded at the end of each session on August 28, 2018.

# Table of Contents

Presentation Instructions	9
Keynote Speaker Introductions	10
<b>Session 1</b>	
G0019: Adaptive Harmonic current detection implemented by using digital signal processor <i>Sakhon Woothipatanapan, Chanchai Prugpadee</i>	14
G0020: Impact of Capacitor Placement on Medium Voltage for Improve the Power Factor <i>Nattachote Rugthaicharoencheep, Chatpong Boobpa</i>	14
G0022-a: A study on General Performance Requirements of the Network Gateway for Distributed Energy Resource <i>HyunJin Shim, HyeonGi Lee, EunJi Choi, Min Sun</i>	15
G0030-a: Effect of Acetone-Butanol-Ethanol (ABE) Addition on Aromatic Species in Fuel-rich, Premixed Toluene Reference Fuel (TRF) Flame <i>Jianfei Luo, Qixing Zhang, Yongming Zhang, and Jinjun Wang</i>	15
G0032-a: The Applications of Taiwan 2050 Calculator <i>Ya-Yin Hsu</i>	16
K1008-a: Encouragement of residents' pro-environmental behaviour on electricity consumption with smart meters in a competition in residential hall <i>Fu-Ki MAK, Jimmy Chi-Hung FUNG, Lam-Lung YEUNG</i>	16
K0012: Risk Analysis of Power Information Control System based on Smart Grid Security Standardization <i>Pil Sung Woo, Balho H. Kim</i>	17
G4003: Preliminary experimental of GPU immersion-cooling <i>Nugroho Agung Pambudi, Husain Bugis, Ilham Wahyu Kuncoro, Nova Dany Setiawan, and Miftah Hijriawan</i>	17
<b>Session 2</b>	
G0008-a: Cooking-oil Fume Purification by HiGee Scrubber with Green Surfactants: Case Study of Street Fried-Food Stall in Taiwan Night Market <i>Min-Hao Yuan, Yi-Hung Chen, Chun-Ming Chang, Pei-Ting Hsu</i>	18
G0009: Potential of The Return Sludge to Increase Biogas Production from Cow Manure <i>Ambar Pertiwinigrum, Ratih Kusuma Wardani, Joko Wintoko, Rachmawan Budiarto, Margaretha Arnita Wuri, and Misri Gozan</i>	18
G0010: Generating Renewable Energy from Municipal Waste Sector: A Comparative Study between Japan and Indonesia <i>Jatmiko Wahyudi and Mayang Rahmi Novitasari</i>	19
G0017: Efficiency of Grease Residue from Grease Trap Waste Water Treatment for Candles Production	19

***Nisa Pakvilai***

G0029: Air Pollution and Control of Cargo Handling Equipments in Ports 20

***Zhu Li, Chen Jun Feng, and Duan Jun Ya***

G0031: Water Security in Green Campus Assessment Standard 20

***Mia Wimala, Bob Zirads, and Rindu Evelina***K0005-a: Effects of plant growth promoting bacteria on KDML105 (*Oryza sativa* L.) growth and yield 20***Lalita Thanwisai, Wilailak Siripornadulsil and Surasak Siripornadulsil***

K0006-a: Biodiversity of lactic acid bacteria in floral nectar 21

***Sureporn Wichiansri, Surasak Siripornadulsil and Wilailak Siripornadulsil*****Session 3**

K1002-a: Effects of oral feeding with probiotic bacteria on microbial population and cecum morphology of broiler chicken 22

***Nalisa Khochamit, Surasak Siripornadulsil and Wilailak Siripornadulsil***K1003-a: *Pentosaceus* and *Lactobacillus casei* to eliminate food poisoning bacteria in pla-som-fak, a Thai low-salt fermented freshwater fish 22***Nawarat Rattanadilok na pheket, Surasak Siripornadulsil, Lekha Prasarthong and, Wilailak Siripornadulsil***

K1004-a: Phenotypic characteristics of heavy metal-tolerant bacteria and yeasts in response to cadmium 23

***Wilailak Siripornadulsil, Soraya Tra-ngan and Surasak Siripornadulsil***

K1007-a: Effects of bacteria on photosynthetic pigments of rice seedling grown in As-supplemented solution 24

***Surasak Siripornadulsil, Sarun Thongnok, and Willailak Siripornadulsil***

G0044-a: Investor Sentiment, Traders' Behavior and Price Efficiency in Crude Oil Futures Markets 24

***Yu-Lun Chen***

G0038-a: Removal of Linear Alkyl-benzene Sulphonate and Caffeine from Domestic Wastewater in Trickling Filters Using Algal-bacterial Consortia 25

***Keerthi Katam, Satoshi Soda, Toshiyuki Shimizu, Debraj Bhattacharyya***

G0039: Application of a Continuous Bipolar Mode Electrocoagulation (CBME) system for Polishing Distillery Wastewater 25

***Madhuri Damaraju, Debraj Bhattacharyya, Tarun panda, and Kiran Kumar Kurilla***

G0040: Recovery of Reducing Sugar From the Pith of Green Coconut Using Sequential Hydrothermal Pretreatment and Enzymatic Saccharification: Modelling of the Process Using Response Surface Methodology 26

***Marttin Paulraj Gundupalli, Nishanth Senthilkumar, and Debraj Bhattacharyya***

K2006-a: Effects of Mushroom Substrates on Chemical Speciation of Heavy Metals in Contaminated Soils	26
--	----

*Danyang Li, Kokyo Oh, Hongyan Cheng, Tetsushi Yonekura, Shinichi Yonemochi, Yugo Isobe*

## Poster Session

G0001: Field Measurements for Solar Water Heaters in a Mushroom Plant	27
---	----

*Keh-Ching Chang, Wei-Min Lin, Kung-Ming Chung*

G0034-a: Development of Refrigerant Retrieval and Refinery System Using Condensing Heat	27
---	----

*Jung-In Yoon, Chang-Hyo Son, Kwang-Hwan Choi, Young-Bok Kim, Won-Sil Seol, Jae-Dol Kim and Kwang-Seok Lee*

G3001-a: Heat transfer characteristics on a new type of photovoltaic/thermal system with a rectangular turbulence promoter	28
--	----

*H.U. Choi, R. Fatkhur, J.R. Kim, Y.B. Kim, C.H. Son, J.I. Yoon, K.H. Choi*

G3002-a: Supercritical Cooling Heat Transfer Characteristics of CO <sub>2</sub> in a Gas Cooler	28
---	----

*Chang-Hyo Son, Kwang-Hwan Choi, Suk-Ho Jung, Ji-Won Yoon, Min-Ju Jeon, Joon-Hyuk Lee*

G0021: Immobilization of isocitrate dehydrogenase on mesoporous silica foam for carbon dioxide capture	29
--	----

*Shunxiang Xia, Laibao Zhang, Enjelia Veony*

K0007-a: Analysis of the Changes in the IDF Curve for Temporal Resolution	29
---	----

*Kim, Kyungmin, Kim, Sangdan*

K1001-a: Retrospect and Prospect of Soil and Groundwater Bioremediation in Taiwan	30
---	----

*Chun-chi Lai, Chia-Che Lee, Shyh-Wei Chen, I-Hsing Chen*

G0041: Sliding mode control of biogas production by anaerobic digestion with addition of acetate	30
--	----

*Plamena Zlateva*

K0014-a: Qualitative Study for Plastic Microbeads in Personal Care and Cosmetics Products	31
---	----

*Dong, Tzu-Tong, Jin, Siao-Yi, Kuo, An-Fu*

List of Listeners	32
-------------------	----

One Day Visit	33
---------------	----

Note	34
------	----

Feedback Information	37
----------------------	----



# Presentation Instructions

## Instructions for Oral Presentations

### *Devices Provided by the Conference Organizer:*

Laptop Computer (MS Windows Operating System with MS PowerPoint and Adobe Acrobat Reader)

Digital Projectors and Screen

Laser Sticks

### *Materials Provided by the Presenters:*

PowerPoint or PDF Files (Files should be copied to the Conference laptop at the beginning of each Session.)

### *Duration of each Presentation (Tentatively):*

Regular Oral Presentation: about **12** Minutes of Presentation and **3** Minutes of Question and Answer

Keynote Speech: about **30** Minutes of Presentation and **5** Minutes of Question and Answer

## Instructions for Poster Presentation

### *Materials Provided by the Conference Organizer:*

The place to put poster

### *Materials Provided by the Presenters:*

Home-made Posters

Maximum poster size is A1

Load Capacity: Holds up to 0.5 kg

## Best Presentation Award

One best oral presentation will be selected from each oral presentation session, and the Certificate for Best Oral Presentation will be awarded at the end of each session on August 28, 2018.

## Dress code

Please wear formal clothes or national representative of clothing.

# Keynote Speaker Introductions

## Keynote Speaker I



Prof. Wallace C.H. Choy  
Hong Kong University, Hong Hong

**Prof.** Wallace Choy received Ph.D Degree in Electronic Engineering from University of Surrey, UK in 1999. After vigorous working experiences in National Research Council of Canada and Fujitsu at San Jose, on investigating optoelectronic devices, he is now a professor of Department of Electrical and Electronic Engineering, the University of Hong Kong. His current research interests are concerned with organic/inorganic optoelectronic devices, plasmonic structures, and nano-material devices and physics. Prof. Choy has been recognized as the Top 1% of most-cited scientists in Thomson Reuter's Essential Science Indicators (ESI) in 2014, 2015, 2016 and 2017. He has been named as prolific researcher on organic solar cells in the index (WFC in physical sciences) in Nature Index 2014 Hong Kong published by Nature. He has published over 180 internationally peer-reviewed journal papers, contributed to seven book chapters, US and China patents and edited one book published in Springer. He has served as Member of Engineering panels of Hong Kong Research Grant Council, Editorial Board Member for Nature Publishing Group on Scientific Reports, Wiley on Solar RRL and Institute of Physics on J Physics D, senior editor of IEEE Photonics Journal, topical editor of OSA Journal of the Optical Society of America B, and guest editor of OSA Journal of Photonic Research, and Journal of Optical Quantum Electronics. He is a fellow of OSA.

### **Topic: “Highly Stable and Efficient Thin-Film Photovoltaic Devices”**

**Abstract:** While high temperature evaporation and sputtering are commonly used for fabricating solar cells, we will discuss our simple and scalable solution-processed solar cells including the carrier transport layers to the active layers. We will demonstrate that our metal oxide based carrier transport layers with the good electron and hole transport properties can be used to form all solution-processed organic/inorganic optoelectronics such as organic solar cells (OSCs), perovskite solar cells, dye sensitized solar cells, organic light emitting diodes, etc which can favor the efficient transport of carriers between the photoactive layer and electrode as well as high optical transparency. Transition metal oxides are promising materials for carrier transport layers because of their good electrical properties, stability, and optical transmission. We also propose and demonstrate several low-temperature solution-processed approaches for forming transparent and efficient metal oxide-based carrier transport layers including electron and hole transport layers. With the incorporation of metal nanoparticles, the electrical and optical properties can be enhanced. The interesting features of the novel carrier extraction layers are low temperature, solution process and water free for high performance optoelectronics such as OSCs with power conversion efficiency (PCE) of 10.5%. In addition, we have developed some room-temperature processed Ag nano-network which can serve as transparent flexible electrodes. With the knowledge of solution processed organic and inorganic materials, we also propose different approaches for highly stable and efficient perovskite SCs with no hysteresis and most recent PCE of 20.5%.

## Keynote Speaker II



Prof. Miwako Hosoda  
Seisa University, Tokyo, Japan

**Prof. Miwako Hosoda**, Vice-President of Seisa University, has been doing her sociological research in the field of healthcare and environmental sciences. She is interested in the balance of human activities and advocates the protection of natural environments. Dr. Hosoda is also working to achieve a sustainable healthcare policy, and promotes the public's participation in the medical domain, both globally and locally. She graduated from the Department of Sociology at the University of Tokyo in 1992, and received an MA and PhD in Sociology from the University of Tokyo. After spending time as a research fellow in the Japan Society for the Promotion of Science, she studied at Columbia University Mailman School of Public Health and Harvard School of Public Health. Dr. Hosoda is now serving as a board member for the International Sociological Association, Research Committee of Sociology on Health.

### **Topic: “Protecting the Natural Environment and Creating a Harmony between Nature and Human-beings”**

**Abstract:** The impact of science and technology on human life has given rise to a technology-mediated environment, presenting new issues concerning environmental ethics. Having pointed out the need for sustainable development in the global society, preservation of the ecosystem, including the regulation of carbon dioxide emissions, has become a worldwide issue. Japanese society has faced many major environmental problems such as air and water pollution, due to the rapid economic development since the 1960s. This has led to the endangerment of native animal and plant species.

In such a situation, Japan's previous stance was to pursue only the country's economic development. However, nowadays, people are beginning to disapprove this way of thinking. These people are not only those who make a living on agriculture and fishing; the government, scientists and engineers, and researchers are also willing to cooperate in this movement of rejecting the idea of prioritizing the economy over everything else. Furthermore, rather than simply aiming to protect the environment, this movement is now beginning to present ideas in which both nature and humans can coexist. This may be regarded as a new social movement. I wish to raise the symbiosis between humans and nature by incorporating cases such as the breeding of the Toki in the Sado Island of Niigata Prefecture and the aquaculture of oyster in Kesenuma, Miyagi Prefecture. I think there is much we can learn through discussing such instances where human-beings are able to contribute to the protection of our environment.

## Keynote Speaker III



Prof. Kokyo Oh

Center for Environmental Science in Saitama, Japan

**Prof. Kokyo Oh** is a senior researcher in Center for Environmental Science in Saitama, Japan. He graduated with his MSci degree and Ph.D. degree (soil science) in Chinese Academy of Sciences, and was honored as a STA research fellow by Japan government from 1997 to 1999. The research areas include soil science, environmental conservation, environmental chemistry, and atmospheric environment. His current research is mainly on soil remediation, environmental agronomy, atmospheric PM<sub>2.5</sub> and water environment conservation. He has published more than 90 publications.

### **Topic: “Contamination of Agricultural Soils and its Conservation with Phytoremediation technology”**

**Abstract:** Extensive contamination of agricultural soils with various heavy metals has been a great health concern worldwide, because of their potential reactivity, toxicity, mobility and long-lasting effects on the ecosystems. There is a great need to develop effective technologies for treatment of these contaminated soils as recoverable soil resources. There are some conventional soil treatment technologies including physicochemical and thermal processes, anyway, they are usually extremely expensive, and destroy the soil bio-productivity, possibly leading to the loss of soil resources.

Recently, phytoremediation as a cost effective and environmentally friendly soil treatment technology has been developed, in which green plants are used to remediate the contaminated soils without destroying the soil properties. The traditional phytoremediation are mainly used special plants known as hyperaccumulators.

In the current report, the characteristics and development of phytoremediation were introduced, and a profitable phytoremediation strategy was suggested. The profitable phytoremediation used resourceful plants, instead of the special hyperaccumulator plants, for both utilization and remediation of the contaminated soil. In this strategy, the owners of contaminated sites possibly cost nothing, but can obtain economic income through selling the resources crops to factories for production of biofuel or to the market as ornamental flowers. Through this way, the practical application of phytoremediation can be effectively promoted, and then the agricultural soil resources can be conserved.

So far experiments from pot culture to field demonstration have been carried out, and results show that phytoremediation using resourceful plants work effectively for remediation of contaminated soils as well as for generation economic benefits to the owners of contaminated sites. Therefore, we suggest the profitable phytoremediation system as a reasonable choice for remediation of contaminated sites. The phytoremediation technologies with low impact on the environment can be utilized reducing those strategies destroying a not renewable essential soil resource. (This work was supported by JSPS KAKENHI No.16H05633).

## Keynote Speaker IV



Prof. Chan Jin Park

Incheon National University, Republic of Korea

**Prof.** Park Chan Jin graduated from Korea University, and got Master and PhD degrees in same university. His major fields of research are the air pollution control, greenhouse gas technology and odor management technology. His another interests is green growth policy. He is now full-professor in Incheon National University at Urban and Environmental Engineering School. Recent research areas are odor pollution control technology, hazardous chemical management and policy of countermeasures against climate change.

### **Topic: “On the Policy of Global Warming Countermeasures to Cope with Convention on Climate Change”**

Abstract: Recently, various climate disasters are becoming more frequent due to the extreme weather with global warming phenomena, and it is becoming more difficult to maintain a comfortable life in recent years. Therefore the adaptation strategy for climate change protocols is very necessary task to overcome this phenomenon with taking countermeasures actively and pursuing the sustainability of better life in the future. This study investigated the low carbon policy that is being pursued since the recent Paris agreement on climate change, and estimated the implementation plan of related fields, and discussed the ways of cooperation to achieve the sustainable development goals.

**Tips:** The schedule for each presentation is for reference only. In order not to miss your presentation, we strongly suggest that you attend the whole session. Please arrive at conference room 10 minutes before the session beginning to upload PPT into conference laptop.

# Session 1

**Afternoon, August 28, 2018 (Tuesday)**

**Time: 13:00~15:00**

**Venue: 3201 (Building 3, Second Floor)**

**Session 1: 8 presentations-Topic: “Power and Energy Engineering”**

**Session Chair: Prof. Wallace C.H. Choy**

## **G0019 Presentation 1 (13:00~13:15)**

Adaptive Harmonic Current Detection Implemented by Using Digital Signal Processor

**Sakhon Woothipatanapan**, Chanchai Prugpadee

Rajamangala University of Technology Phra Nakhon

*Abstract*—This paper aims to develop an efficient method for accurate detections of harmonic current distortions in power system for control of an active harmonic filter. The adaptive noise cancellation theory was originally developed for noise signal processing is applied for this control for active harmonic filter. There are many algorithms for adaptive noise cancellation, which least mean square algorithm and recursive least square algorithm are most used. Since recursive least square algorithms is more effective. Therefore, this research has carried out a real time implementation to detect harmonic current distortion in power system by using digital signal processor kit TMS320C6713 for the adaptive harmonic filter.

## **G0020 Presentation 2 (13:15~13:30)**

Impact of Capacitor Placement on Medium Voltage for Improve the Power Factor

**Nattachote Rugthaicharoencheep**, Chatpong Boobpa

Rajamangala University of Technology Phra Nakhon

*Abstract*—This paper presents impact of capacitor placement on medium voltage for improve the power factor value to AC motor. In present, the electrical power system has focus on improving the Power Factor significantly because it is the major key to increase or decrease the applicable expenses. The power system that has low power factor will have a lot of loss to system, especially when electrical voltage is on voltage medium. When power factor has been adjusted, the system can take more loads and electrical power loss is decreased. It also decreases voltage in power line and decreases electrical bills at the same time. This article presents the theory to analyze data from motor that needs to adjust a power factor so that it pass electricity authority standard by considering the efficiency of the motor so that the consumers do not have to pay the penalty of the power factor value differences to the Electricity Authority. Furthermore, it can help decrease the bills of unstandardized electrical power which occurred in the system and enable the system to take more loads at the same time.

**G0022-a Presentation 3 (13:30~13:45)**

A study on General Performance Requirements of the Network Gateway for Distributed Energy Resource

**HyunJin Shim**, HyeonGi Lee, EunJi Choi, Min Sun  
Korea Smart Grid Association, Korea

*Abstract*—Recently, various distributed energy systems have been developed and studied. As the market grows, a solution for integrating distributed energy systems is required. Also, a need for developing standard that guarantees communication interoperability for each system has been increased.

Nowadays, IEC 61850 data model is recommended for both domestic and international data models that are applied to distributed energy resources.

So in this paper, general performance requirements of the network which support IEC 61850 gateway for distributed energy resource (DER) are defined using IEC 61850 data model.

Especially, this paper describes structure, function, hardware and software design requirements of the IEC 61850 gateway for DER. Furthermore, the IEC 61850 standards which allow the gateway to refer the necessary logical nodes and associated data information models to enable unified control and management of different DERs are defined.

IEC 61850 gateway for DER enables new market entrants to monitor, control, maintain and operate various DERs easily by using this standard. Also, the basic design requirements and performance test methods defined in this standard can ensure the performance of the IEC 61850 gateway for DER and expand the horizon to domestic and foreign market. However, as the matter of cost and certification problems, this standard is developed as recommendation.

**G0030-a Presentation 4 (13:45~14:00)**

Effect of Acetone-Butanol-Ethanol (ABE) Addition on Aromatic Species in Fuel-rich, Premixed Toluene Reference Fuel (TRF) Flame

**Jianfei Luo**, Qixing Zhang, Yongming Zhang, and Jinjun Wang  
University of Science and Technology of China

*Abstract*—Soot particles from vehicles, especially diesel vehicles is a significant contributor to atmospheric PM<sub>2.5</sub>, it is very necessary to increase the adoption of oxygenated fuels as alternative fuels to reduce pollutant emissions. Acetone-Butanol-Ethanol (ABE), the intermediate product in bio-butanol production process using biological fermentation purification technology, has been proposed to blend diesel directly for saving the high energy requirement of separating purity butanol. This work aims at understanding how the ABE affects the polycyclic aromatic hydrocarbons (PAH) which are the precursors of soot formation in flame. An ABE-diesel kinetic model using toluene and n-heptane as primary reference fuels for diesel was developed. The laminar premixed flame structures of toluene-heptane, ABE-toluene-heptane, and neat butanol-toluene-heptane were calculated. It was found that each fuel in blends burns respectively and has no significant effects on other fuels. Inhibition rate analysis, sensitively analysis, and path flux analysis were used to determine the mechanism that ABE affect aromatic species formation and consumption. It was shown that volume dilution effects and step by step amplification effects are the main

methods to decrease the concentration of aromatic species in the presence of ABE. In addition, the increased HO<sub>2</sub> and OH concentration induced by butanol and ethanol degradation promote the oxidation consumption of aromatic species. However, the decomposition of butanol in ABE produce more benzene precursors, and the CO emission is increased for the degradation of acetone. The Threshold Sooting Index (TSI) calculated from fuel consumption rate and smoke point were used to evaluate the sooting tendency of ABE-diesel blends and butanol-diesel blends. The results proved that ABE-diesel has a lower sooting tendency than butanol-diesel.

### **G0032-a Presentation 5 (14:00~14:15)**

The Applications of Taiwan 2050 Calculator

**Ya-Yin Hsu**

Industrial Technology Research Institute

*Abstract*—Taiwan 2050 Calculator is a series of tools constructed by the Industrial Technology Research Institute and the UK government. These tools are combined with the Industrial Research Institute's previous database of energy research and energy conservation and carbon reduction technologies to develop future scenarios for various technologies such as Taiwanese energy supply sector, residential commercial sector, industrial sector, and transportation sector, and set these scenarios. These tools can be used to explore the impact of future energy development scenarios on all aspects of society, including energy security, energy prices and environmental impacts. In addition, these tools have also been given the purpose of public communication, so that the public understand the challenges of Taiwanese current energy development situation, and educate the development of the people's energy needs to be balanced in different aspects.

This study will introduce the construction of the core model of this series of tools. First of all, it explores the UK original model and introduces how to extend the original model into the model of localization in Taiwan. Then use these tools to simulate the relevant data of Taiwanese current planning and future energy development and explore its future results. In the end, we introduce the process and effectiveness of this study to communicate citizens through the Taiwan 2050.

### **K1008-a Presentation 6 (14:15~14:30)**

Encouragement of residents' pro-environmental behaviour on electricity consumption with smart meters in a competition in residential hall

**Fu-Ki MAK, Jimmy Chi-Hung FUNG, Lam-Lung YEUNG**

The Hong Kong University of Science and Technology, Hong Kong

*Abstract*- The residential sector consumed over 28% of world's electricity and one-fifth of Hong Kong's electricity. Much effort had been put on reducing energy consumption among residential area. This study aimed at evaluating the impact on how energy-saving competition encourages residents' pro-environmental behaviour in a university student hall in Hong Kong. It combines with real-time electricity meters to quantify subsequent behavioural change and further investigate the change in their attitudes in energy saving behaviour. In this study, 200 residents were divided into four groups, three of which were given different directions in



energy saving and the remaining group acted as control group. Real-time electricity usage was provided on an hourly basis through web and mobile application. The participants from the same group competed with each other for four weeks to win prizes. We opted three approaches for each group to look into what would bring significant behavioural change to pro-environmental behaviour. The first is giving residents their current energy usage information and energy-saving tips. The second is peer pressure, that students were informed their energy usage compared to peers. The third is a mix of the two previous approaches. Participants' feedback was collected through baseline and follow-up surveys and focus group interviews. During the competition, the electricity consumption dropped approximately 8.7% compared to baseline level. Furthermore, residents expressed their active engagement in energy-saving behaviours (over 63%) in the competition period. Results showed that information, real-time data and prizes incentive could encourage residents to lower electricity usage.

### **K0012 Presentation 7 (14:30~14:45)**

Risk Analysis of Power Information Control System based on Smart Grid Security Standardization

Pil Sung Woo, **Balho H. Kim**

Hongik University, Rep. of Korea

*Abstract-* The smart grid has emerged to meet the rapidly increasing power demand and solve environmental problems through sustainable development. Advanced power networks are being developed to improve the efficiency of power system operation and energy utilization. The advancement of power networks enables us to collect power information in real time, build a database, and optimally control it by utilizing various applications of organically constructed energy management systems. Currently, the rapid change in power infrastructure necessitates security, and the establishment of a cyber security system is essential. Therefore, this paper analyzes the functions of the power information control systems and calculates the risk level for each component by applying the security risk estimation criteria in the Korean Smart Grid security standard (SGSF-121-1-1).

### **G4003 Presentation 8 (14:45~15:00)**

Preliminary experimental of GPU immersion-cooling

**Nugroho Agung Pambudi**, Husain Bugis, Ilham Wahyu Kuncoro, Nova Dany Setiawan, and Miftah Hijriawan

Univesitas Negeri Sebelas Maret, Indonesia

*Abstract*—Immersion cooling is the latest trend in cooling systems. It's a cooling procedures that is carried out by just immersing all computer components in a dielectric coolant. This research is examined the cooling process of GPU using immersion method. Mineral oil is used as a medium fluid which has high dielectric strength. We measure the temperature drop between fan and immersion cooling method. The result shows that the Immersion cooling method proved able to produce lower GPU temperature compared to cooling non-immersion cooling in conventional fan. The working temperature at immersion GPU is 70 °C while it is 80 C at fan conventional method.

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## Session 2

**Afternoon, August 28, 2018 (Tuesday)**

**Time: 13:00~15:00**

**Venue: 3202 (Building 3, Second Floor)**

**Session 2: 8 presentations-Topic: “Environmental Engineering and Biological Science”**

**Session Chair: Prof. Kokyo Oh**

### **G0008-a Presentation 1 (13:00~13:15)**

Cooking-oil Fume Purification by HiGee Scrubber with Green Surfactants: Case Study of Street Fried-Food Stall in Taiwan Night Market

**Min-Hao Yuan**, Yi-Hung Chen, Chun-Ming Chang, Pei-Ting Hsu  
China Medical University, Taichung 404, Taiwan

*Abstract*—Street foods in night market and street-food stalls are the most attractive cultural customs in Taiwan and the quintessential Taiwanese experience for international visitors. However, public nuisance disputes for unpleasant smells (odour pollutants) and fine particulate matter (PM<sub>2.5</sub>) by cooking-oil fumes (COF) have been constantly increased from the residences near the night markets in Taiwan. To tackle this issue, this study developed a small-scale high-gravity rotating packed bed (Hi-Gee RPB) as a chemical scrubber for the COF purification (covered area of 0.17 m<sup>2</sup>, gas capacity of 15 m<sup>3</sup>/min and scrubbing solution of 20 L) with a green-formula surfactant (H6) for increasing the simultaneous removal efficiencies of PM<sub>2.5</sub> ( $\eta_{\text{PM}_{2.5}}$ ) and odour pollutants. The results showed that the purification performance of H6 was better than these of water and traditional detergent. The concentration of PM<sub>2.5</sub> was decreased from 3.5–7 to 0.5–0.7 mg/m<sup>3</sup> with a  $\eta_{\text{PM}_{2.5}}$  of 84–87%, while  $\eta_{\text{PM}_{2.5}}$  of water and the traditional detergent were only 17–30% and 70–72%, respectively. Therefore, Hi-Gee RPB with a green-formula surfactant is a viable purification device for simultaneous removal of PM<sub>2.5</sub> and odour pollutants from fried-food stall in night market.

### **G0009 Presentation 2 (13:15~13:30)**

Potential of The Return Sludge to Increase Biogas Production from Cow Manure

**Ambar Pertiwinigrum**, Ratih Kusuma Wardani, Joko Wintoko, Rachmawan Budiarto, Margaretha Arnita Wuri, and Misri Gozan  
Universitas Gadjah Mada

*Abstract*—The energy needs in Indonesia are mainly fulfilled by fossil fuels based energy. Since there is the rise of fuel price, Indonesia government considers seeking alternative energies from renewable resources. Biogas becomes one of the alternative energy that

supplies energy needs and manages cow manure waste in Indonesia. To increase adoption of biogas technology, biogas production through methane enrichment is required. The experiment was conducted with return sludge system. These instruments consist of a series portable bio-digester, gas holder and return sludge unit. There were three treatments on biogas production without and with sludge addition or re-use bio-digester sludge that produced after biogas production as raw material for next biogas production. Biogas that produced was observed every two days during 40 days. The results showed that the addition of bio-digester sludge increased biogas production and methane concentration. The optimum retention time of biogas production with sludge addition was 20 days with accumulation biogas volume of 156.38 liters or increased of 38.75 from biogas production without bio-digester sludge). The optimum retention time to increase methane level was 15 days with methane enrichment from 0.8% to 29.41%.

### **G0010 Presentation 3 (13:30~13:45)**

Generating Renewable Energy from Municipal Waste Sector: A Comparative Study between Japan and Indonesia

**Jatmiko Wahyudi** and Mayang Rahmi Novitasari

BAPPEDA Pati, Indonesia

*Abstract*—Although Indonesia has abundant resources to produce renewable energy (RE) from municipal solid waste (MSW), the implementation of waste to energy (WtE) concept remains low due to several factors. Approximately, 200,000 tons of MSW per day are generated in Indonesia. Improper waste management system in Indonesia is not only causing environmental problems but also inhibiting to get benefits from RE production. This study which was funded by Japan International Cooperation Agency (JICA) was conducted to obtain a comparative description of WtE implementation between Japan and Indonesia as well as to formulate possible strategies for improving WtE implementation in Indonesia. Direct observations and a series of qualitative depth interviews with stakeholders were conducted both in Japan and Indonesia. This study revealed that the two countries have a different approach of WtE implementation. The implementation of WtE in Japan mostly relies on thermal treatment as a form of intermediate treatment of MSW to reduce the amount of waste sent to landfill as well as to increase the life span of landfill. In Indonesia, WtE implementation mostly uses the biological treatment (anaerobic digestion) as a part of final treatment of MSW in landfill. Conducting integrated waste and energy management system is one of best practices from Japan that can be learned and applied in Indonesia to improve the implementation of WtE.

### **G0017 Presentation 4 (13:45~14:00)**

Efficiency of Grease Residue from Grease Trap Waste Water Treatment for Candles Production

**Nisa Pakvilai**

Valaya Alongkorn Rajabhat University Under the Royal Patronage

*Abstract*—This study aims to investigate the properties of grease residue from grease trap waste water treatment and to determination the performance of candles from grease residues.

Grease residue from grease trap wastewater treatment system at Canteen in Valaya Alongkorn Rajabhat University Under the Royal Patronage. The results showed that the physical properties of stored grease for more than 2 weeks were gray, high viscosity and foul odor. For new grease, is yellow light, soft texture, and odorless. This study uses a new fat density of 1.002 g/mL, the moisture content 58.04%, and the heating value was 8148.63 kcal / kg. The physical properties of the candles are produced at an appropriate ratio of 3: 1 (paraffin: grease residue). In comparison with conventional candles, the candles last for 2 hours and 10 minutes, but the candles are 3: 1 for 2 hours and 8 minutes, and 15 minutes with smoke.

### **G0029 Presentation 5 (14:00~14:15)**

Air Pollution and Control of Cargo Handling Equipments in Ports

**Zhu Li**, Chen Jun Feng, and Duan Jun Ya

China Waterborne Transport Research Institute

*Abstract*—In order to reduce and control air pollution caused by cargo handling equipments in ports, China's transportation authority has proposed the goal of accelerating the elimination of old high-emission cargo handling equipments. This paper studies and constructs a dynamic method based on the level of cargo handling equipments activity to estimate the emissions of atmospheric pollutants. The results show that in 2017, if the engines of cargo handling equipment are upgraded and comply with Chinese standard Tier III, the air pollution will be significantly reduced. We show the ranking of the emission of air pollution of different type of equipment in ports. The government will make a good decision on air pollution and control with our research results.

### **G0031 Presentation 6 (14:15~14:30)**

Water Security in Green Campus Assessment Standard

**Mia Wimala**, Bob Zirads, and Rindu Evelina

Universitas Katolik Parahyangan

*Abstract*—The importance of fresh water in human life entails people to be conscious of conserving the resources that only one percent of the total fresh water on the earth is easily accessible. Green campus is a concept implemented by the campus where the policies are supposed leading to ecological points of view. This research aims to update the UI GreenMetric standard, focusing on Water (WA) category as a recommendation for Universitas Indonesia as the initiator. Referrals from other related standards, i.e. STARS<sup>®</sup> and Greenship were done on developing the category with its contents. Furthermore, the re-weighting and re-scoring system of the newly developed category were carried out using Analytical Hierarchy Process method, adjusted to the existing laws/regulations in Indonesia. For verification purpose, a study on campus performance at Universitas Katolik Parahyangan, was conducted using the newly developed category. The proposed strategies were then set to improve the campus performance in the future.

### **K0005-a Presentation 7 (14:30~14:45)**

Effects of plant growth promoting bacteria on KDML105 (*Oryza sativa* L.) growth and yield

**Lalita Thanwisai**, Wilailak Siripornadulsil and Surasak Siripornadulsil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand

*Abstract-* Rice is the most popular cereal grain and edible for half of the world's population. To ensure food security and good quality of environment, rice production must be developed without adding more fertilizer since it causes a high cost and contamination in an environment. We were presently interested in plant growth promoting bacteria (PGPB) namely *Cupriavidus taiwanensis* KKU2500-3. It was isolated from paddy field of North Thailand. *C. taiwanensis* KKU2500-3 also was able to fix nitrogen, produce IAA, and solubilize phosphate. In pot experiment, the bacterium did not affect all growth parameters of Thai jasmine rice (KDML105) when either applied alone or in combination with varying rates at half and full of NPK fertilizer. 16-8-8 and 46-0-0 fertilizers was applied However, *C. taiwanensis* KKU2500-3 was able to increase grain weight and filled grain by 12.15 and 42.50%, respectively.

### **K0006-a Presentation 8 (14:45~15:00)**

Biodiversity of lactic acid bacteria in floral nectar

**Sureporn Wichiansri**, Surasak Siripornadulsil and Wilailak Siripornadulsil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand

*Abstract-* Flowers naturally produce the floral nectar to attract animal pollinators for pollination and fertilization. During pollination, the pollinators concurrently transferred a microflora between flowers and other plants. The nectar was suggested to limit growth of microflora since it consists of highly concentrated sugars. Recently, many reports demonstrated the presence of a variety of bacterial species in the floral nectar including lactic acid bacteria (LAB). LAB are industrially important microorganisms due to their GRAS (Generally Recognized as Safe) status and probiotic properties. The aims of this study are to isolate, characterize and identify LAB from floral nectars collected from Khon Kaen University and the plant genetic conservation area of Chulabhorn Dam, Thailand. A total of 115 flower samples were surface sterilized, ground and spread on de Man, Rogosa and Sharpe (MRS) agar supplemented with 1% calcium carbonated and 0.004% bromocresol purple. After screening by Gram staining and catalase-oxidase tests, 8 LAB isolates were selected and characterized. They were demonstrated as homo-fermentative, tolerance to a high concentration of sucrose, and non-hemolytic. Based on 16S rDNA molecular identification, 6 species were identified and assigned as *Lactobacillus rhamnosus* MA3 (100%), *Lactobacillus plantarum* FL10 (100%), *Enterococcus faecalis* AC45 (100%) and TE49 (100%), *Enterococcus faecium* PL11 (91%), *Welliscella confusa* HA1 (100%) and HR1 (100%), and *Lactococcus graviae* THE65 (100%). These results suggested that LAB species able to colonize in the floral nectar were highly diverse and may be derived from the animal pollinators. Among 6 species, *L. rhamnosus* and *L. plantarum* were well-characterized and many strains were known as potential probiotics. Hence, the MA3 and FL10 strains will be further investigated as a bio-supplement in high sugar foods.

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# Session 3

**Afternoon, August 28, 2018 (Tuesday)**

**Time: 15:15~17:30**

**Venue: 3201 (Building 3, Second Floor)**

**Session 3: 9 presentations-Topic: “Environmental Engineering and Biological Science”**

**Session Chair: Prof. Miwako Hosoda**

## **K1002-a Presentation 1 (15:15~15:30)**

Effects of oral feeding with probiotic bacteria on microbial population and cecum morphology of broiler chicken

**Nalisa Khochamit**, Surasak Siripornadulsil and Wilailak Siripornadulsil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand

*Abstract-* This study aims to determine the effects of *Bacillus subtilis* KKU213, C330 and lactic acid bacteria (LAB) including *Pediococcus acidilactici* SH8, *Enterococcus faecium* CA4, *Lactobacillus salivarius* CH24, and *Enterococcus durans* CH33 on microbiota in the cecum of 45-day-old male Cobb broiler chicken. Chicks were randomly divided into 13 groups, with 6 chicks per group. They were orally fed by H<sub>2</sub>O (control), 1 ml of *B. subtilis* KKU213 (T1), *B. subtilis* C330 (T2), *P. acidilactici* SH8 (T3), *E. faecium* CA4 (T4), *L. salivarius* CH24 (T5), and *E. durans* CH33 (T6), *B. subtilis* KKU213+LAB at days (d) 1, 3, and 5 (T7), *B. subtilis* C330 + LAB at d 1, 3, and 5 (T8), *B. subtilis* KKU213 at d 1 + LAB at d 3, and 5 (T9), *B. subtilis* C330 at d 1 + LAB at d 3, and 5, *B. subtilis* KKU213 at day 1 and 3 +LAB at d 5 (T11), and *B. subtilis* C330 at d 1 and 3 + LAB at d 5 (T12). Total LAB and bacteria in the cecum were counted on MRS and LB agars, respectively. LAB numbers were highest in T5 about  $8.67 \pm 0.061$  log CFU/g. For the total bacteria count on LB agar at 50 °C for a selection of thermophilic *Bacillus* spp., the highest number was also observed in T6. Morphology of chicken epithelial cells in the cecum was observed by scanning electron microscopy (SEM). After feeding with probiotics, the number of villi in 45 day-old chickens was significantly increased. The number of villi in C330 (T2) was higher than KKU213 (T1) and control groups. Among the single LAB-fed groups, the number of villi present in the cecum was highest in CH24 group (T5). In addition, the chickens fed with a combination of C330+LAB strains showed a higher number of villi in cecum than KKU213+LAB strains. Therefore, feeding with a single or mixed probiotic strains was able to enhance the population of some bacteria and nutrient adsorption in broilers, possibly via an increase in their total villi.

## **K1003-a Presentation 2 (15:30~15:45)**

Use of *Pediococcus pentosaceus* and *Lactobacillus casei* to eliminate food poisoning bacteria

in *pla-som-fak*, a Thai low-salt fermented freshwater fish

**Nawarat Rattanadilok na pheket**, Surasak Siripornadulsil, Lekha Prasartthong and, Wilailak Siripornadulsil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen Thailand

*Abstract- Pla-som-fak* is a popular Thai low-salt fermented freshwater fish product in the North eastern part of Thailand. In this study, two strains of lactic acid bacteria, *Pediococcus pentatoceus* PS34 isolated from *pla-som* product and *Lactobacillus casei* OR1 isolated from *Citrus reticulata blanco* were used as a starter culture for *pla-som-fak* fermentation. Each LAB strain was grown overnight in MRS broth and the bacterial cells were collected by centrifugation at 6,000 rpm 15 min. The PS34 or OR1 cell suspension at  $10^9$  cfu/ml was mixed with *pla-som-fak* and incubated at 32 °C. After 24 h, they showed an ability to decrease pH in *pla-som-fak* from 6.65 to 4.58 and 4.52, respectively and affect growth of food poisoning bacteria. The viable cell of spiked *Arcobacter* spp. decreased about 2-log CFU while the numbers of indigenous *Escherichia coli* was reduced from MPN 1100 to 240 and 460 in the fermented samples inoculated with PS34 and Or1, respectively. Therefore, adding PS34 and OR1 LAB strains as a starter culture in *pla-som-fak* during fermentation improved a quality of fermented fish product by inhibiting growth of some food poisoning bacteria.

### **K1004-a Presentation 3 (15:45~16:00)**

Phenotypic characteristics of heavy metal-tolerant bacteria and yeasts in response to cadmium

**Wilailak Siripornadulsil**, Soraya Tra-ngan and Surasak Siripornadulsil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand

*Abstract- Cadmium (Cd) contamination, specifically in the soil is a serious environmental problem. It has been reported worldwide and increased from the anthropogenic activities such as electroplating, fertilizer industries, textiles, mining and metallurgical processing. To reduce a risk of heavy metal that affects living organisms, the detection of heavy metals in the environment is essential. The aim of this study is to characterize the phenotypic changes of heavy metal-tolerant bacteria, Cupriavidus taiwanensis* KKU2500-3 and 7 yeast isolates (K7, K9, K11, K12, K14, K26, K34) when grown in the media under various concentrations. Two media were used, Endo agar with or without 30 µg/mL kanamycin and Congo red agar with 100 µg/mL vancomycin. To determine the effect of Cd on their growth, all isolates were treated with 0-10 mg/L CdCl<sub>2</sub> and incubated at 30 °C for 24-72 h. Either with or without kanamycin, the KKU2500-3 and K12 strains illustrated red colony only on Endo agar in the absence of Cd, while the colonies of all 6 yeast isolates were colorless. In Endo agar plus 1-10 mg/L Cd, KKU2500-3 and K12 represented a colorless colony. On Endo agar containing 30 µg/mL kanamycin and no Cd, K12 isolate showed a pink colony. While on Congo red agar plus vancomycin, KKU2500-3 did not grow, 6 yeast isolates except K26 exhibited a red colony at 0-8 mg/L Cd and colorless colony at 10 mg/L Cd. The visible color changes of bacterial culture observed in this study indicated their difference in sensitivity and specificity of growth in response to Cd. Thus, the KKU2500-3 and K12 strains will be further investigated under various conditions such as media, antibiotics and heavy metal

concentrations. Consequently, their distinct phenotypes could be developed and used to detect the heavy metals in the contaminated samples.

### **K1007-a Presentation 4 (16:00~16:15)**

Effects of bacteria on photosynthetic pigments of rice seedling grown in As-supplemented solution

**Surasak Siripornadusil**, Sarun Thongnok, and Willailak Siripornadusil

Department of Microbiology, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand

*Abstract-* The reduction of pigment content in rice leaf due to As toxicity was affected to reduce growth and yield of rice. Thus, we investigated the effects of co-inoculated with cadmium (Cd)-tolerant and arsenite (As<sup>(III)</sup>)-oxidizing bacteria on photosynthetic pigments including chlorophyll-a (Chl-a), -b (Chl-b), and carotenoid (Car) of 2 rice seedling (RD6 and RD10) grown in As-supplemented solution. The experiment was divided into 4 groups including (1) un-inoculated rice (R); (2) co-inoculated with bacteria including KKU2500-3 and 4.25 (RB-3/25), KKU2500-3 and 4.27 (RB-3/27) and KKU2500-3 and 4.44 (RB-3/44); (3) R grown in As nutrient solution (RAs); and (4) RB grown in As nutrient solution (RBAs). As nutrient solution contained 15  $\mu\text{M}$  of As<sup>(III)</sup> and 30  $\mu\text{M}$  of arsenate (As<sup>(V)</sup>). The result shown that Chl-a, Chl-b, and Car of RAs group were decreased in both RD6 and RD10 up to 78.35 and 18.21 %, respectively (compared with R group). However, the co-inoculated bacteria were able to increase photosynthetic pigments by 0.15-76.43 and 0.07-29.25% in RD6 and RD10, respectively (RBAs and RAs group). Interestingly, the most increase of pigment content were come from RB-3/25 and RB-3/27 found in RD6 and RD10, respectively when grown in As nutrient solution. Well correlation between pigment content and biomass of each rice variety were observed. The results indicated that bacteria could detoxify As toxicity resulting in increased growth and yield.

### **G0044-a Presentation 5 (16:15~16:30)**

Investor Sentiment, Traders' Behavior and Price Efficiency in Crude Oil Futures Markets

**Yu-Lun Chen**

Chung Yuan Christian University, Taiwan

*Abstract—*This article examines the trading behavior and performance of hedgers (i.e., producers, merchants, processors, or users of the commodity) and speculators (i.e., commodity pool operators, trading advisors, or hedge funds) in crude oil futures markets during 2006-2012. Using weekly Disaggregated Commitments of Traders (DCOT) reports from U.S. Commodity Futures Trading Commission, we could classify the trading positions of producers, swap dealers, money managers, and other reportable traders in crude oil futures markets. To find the impact of these four types of traders' positions on price efficiency, we adopt the pricing error approach of Hasbrouck (1993) to evaluate price efficiency, in accordance with the works of Boehmer and Kelley (2009) and Kurov (2008). This paper finds that speculators in oil futures markets belong to positive feedback traders—they buy when prices rise and sell when prices fall; speculators' trading behavior is related with market sentiment. However, speculators' positions have positive impacts on price efficiency, because



speculators correct pricing errors. These findings in this study highlight the role of different type of traders on price formation processes in oil futures—information that is beneficial to academics, practitioners, and regulators.

### **G0038-a Presentation 6 (16:30~16:45)**

Removal of Linear Alkyl-benzene Sulphonate and Caffeine from Domestic Wastewater in Trickling Filters Using Algal-bacterial Consortia

Keerthi Katam, Satoshi Soda, Toshiyuki Shimizu, **Debraj Bhattacharyya**

Indian Institute of Technology Hyderabad, India

*Abstract*—Performance of a photo bioreactor (light reactor - LR), treating micro-pollutants with algal-bacterial consortia, was evaluated and compared with a dark reactor (DR) containing primarily a bacterial consortium. Linear alkyl-benzene sulphonate (LAS) and caffeine were selected as model micro pollutants. LAS is the most widely used surfactant in our daily life. Caffeine is a typical emerging pharmaceutical pollutant. Both the lab-scale trickling-filter type reactors were packed with polyurethane foam sponge cubes (2 cm x 2cm) with 40% occupancy. The LR was operated under light: dark cycle of 12:12 h with a quantum flux of 15  $\mu\text{moles/m}^2/\text{s}$ . Artificial wastewater containing glucose (250 mg/L), LAS (20 mg/L), caffeine (0.1 mg/L), and micro-nutrients were treated using the reactors at 12 and 8 h hydraulic retention times (HRT) under a surrounding temperature of 25°C for 2 months. The results revealed that decreasing the HRT from 12 to 8-h negatively affected on the LAS and caffeine removal efficiency in both the reactors. The LR showed better total organic carbon and total nitrogen removal efficiency of 87.2%, and 27.2%, respectively at 8-h HRT and 85.8% and 20.7%, respectively at 12-h HRT. However, the LAS and caffeine removal efficiency decreased from 99.3% to 81.2% and 96.0% to 84.3% in LR and from 96.2% to 87.5% and 96.0% to 76.5% in DR when HRT was reduced from 12h to 8h. The chlorophyll concentration was highest in the lowest part of the LR. The colony forming unit on selective media of LAS and caffeine degraders was higher in LR compared to DR. The above results indicate that the algal-bacterial symbiotic relationship is beneficial not only for carbon and nitrogen removal but also for micro pollutants removal from domestic wastewater.

### **G0039 Presentation 7 (16:45~17:00)**

Application of a Continuous Bipolar Mode Electrocoagulation (CBME) system for Polishing Distillery Wastewater

Madhuri Damaraju, **Debraj Bhattacharyya**, Tarun panda, and Kiran Kumar Kurilla

Indian Institute of Technology Hyderabad, India

*Abstract*—A continuous bipolar mode electrocoagulation unit has been used in this study for polishing a biologically treated distillery wastewater at laboratory-scale. This study focuses on optimizing the process for removal of Total Organic Carbon (TOC) from an anaerobically-treated distillery wastewater. Response surface methodology (RSM) was used for optimization of the process for maximum removal of TOC. Sample size was performed using Central Composite Design (CCD). Iron electrodes were used for the study. The study was conducted by varying three operating parameters: Initial pH (2-10), reaction time (0.5-15 min), and current density (13-40 A/sqm). High R-square values, above 0.9, were obtained

with ANOVA. Optimal point was observed to be at pH-6.04, Reaction time-11.63 min, current density-39.2 A/sqm. Experimental values of TOC removal at optimal point were found to be 73% against maximum predicted value of 79%. Colour removal efficiency was observed to be 85% at the optimal points. It can be concluded that a continuous bipolar mode electrocoagulation can be a suitable alternative for removal of recalcitrant carbon and colour post-biological treatment in distillery wastewaters

### **G0040 Presentation 8 (17:00~17:15)**

Recovery of Reducing Sugar From the Pith of Green Coconut Using Sequential Hydrothermal Pretreatment and Enzymatic Saccharification: Modelling of the Process Using Response Surface Methodology

Martin Paulraj Gundupalli, Nishanth Senthilkumar, and **Debraj Bhattacharyya**  
Indian Institute of Technology Hyderabad, India

*Abstract*—Coconut pith is a lignocellulosic biomass material consisting of hemicellulose (0.6%), cellulose (24%) and lignin (45%) and is a potential source of biofuel (e.g. bioethanol). In this study, pith was hydrothermally pretreated using high pressure batch reactor under different conditions of time and temperature a) case I (2-10 min: 160-220oC); b) case II (10-60 min: 100-160oC) followed by enzymatic saccharification process using commercial enzymes. Pretreatment was carried out under different conditions to recover maximum reducing sugar and enhance the reducing sugar yield during saccharification. The enzymes used for this study were cellulase (97 FPU/ml) and  $\beta$  – glucosidase (5.1 CBU/mg). The hydrothermal pretreatment process was optimized using Response Surface Methodology (RSM). The solid residues collected after pretreatment were studied for morphological changes using XRD and SEM image evaluation. During the pretreatment step, the reducing sugar recovered was 14% for case I and 4% for case II. During the saccharification process, for case I (43%) and case II (16%) of reducing sugar yield was observed. Compared to the pith pretreated under case I and case II conditions, total reducing sugar recovery (pretreatment and saccharification) of 57% (13.68 mg/g of dry pith biomass) was observed for pith pretreated under optimum condition for case I.

### **K2006-a Presentation 9 (17:15~17:30)**

Effects of Mushroom Substrates on Chemical Speciation of Heavy Metals in Contaminated Soils

Danyang Li, **Kokyo Oh**, Hongyan Cheng, Tetsushi Yonekura, Shinichi Yonemochi, Yugo Isobe

Center for Environmental Science in Saitama, Saitama 347-0115, Japan

*Abstract*—Soil phytoremediation is an emerging low-cost green cleanup technology for contaminated soils with use of green plants to remove, contain, or render environmental contaminants such as heavy metals, trace elements and other toxic chemicals. In this research, a field experiment on mushroom substrate enhanced phytoremediation was studied. The field experiment was carried out to study the effects of mushroom substrates (MS) application on chemical speciation of Cu and Cr in contaminated soil with cultivation of maize, sorghum, and waxy corn. The results showed that total contents of Cu and Cr in the soil with MS

application under the three crops showed a decreasing trend compared with those of non-MS application. In the soil without MS, the reduction rate ranged from 3.2% to 16% for Cu, and from 5.0% to 15% for Cr, respectively, but in the soil with MS application, the reduction rate ranged from 6.2% to -19% for Cu, and from 8.9% to 21%, respectively. The MS application enhanced reduction rate of Cu and Cr in carbonate-bound, organic-bound and residual forms. Among the three crops, the reduction rate of various forms of Cu and Cr in the soil grown with maize was significantly higher than that in the soil grown with sorghum and waxy corn. Except for the content of iron-manganese-oxide-bound Cu in the soil under maize, the treatments of the other two crops with MS application were found had higher reduction rates in various forms of Cu and Cr than those without MS application. The results showed that the MS application could promote the phytoremediation potential of the three crops to the carbonate-bound, organic-bound and residual forms of Cu and Cr. (This work was jointly supported by Shanxi International Cooperation Program No. 201703D421002 and JSPS KAKENHI No.16H05633).

# Poster Session

**Afternoon, August 28, 2018 (Tuesday)**

**Time: 9:00~17:30**

**Venue: 3201 (Building 3, Second Floor)**

**9 Poster presentations**

## **G0001 Poster Presentation 1**

Field Measurements for Solar Water Heaters in a Mushroom Plant

Keh-Ching Chang, **Wei-Min Lin**, Kung-Ming Chung

Tainan University of Technology

*Abstract*—The subsidy program (2000-2017) that has been initiated by the Taiwanese government, has results in an expansion in the market for solar water heaters. The cumulative area of solar collectors installed was approximately 2.61 million square meters at the end of 2017, of which more than 93% have been installed in the domestic sector for hot water production. Industrial heat processes represent another important application for solar heating. However, the attractiveness of a SWH depends on its thermal efficiency and its economic viability. Field measurements for solar water heaters in a mushroom plant are conducted. As a pre-heating system, the thermal efficiency and the energy savings for the system depend on system design and maintenance.

## **G0034-a Poster Presentation 2**

Development of Refrigerant Retrieval and Refinery System Using Condensing Heat

**Jung-In Yoon**, Chang-Hyo Son, Kwang-Hwan Choi, Young-Bok Kim, Won-Sil Seol, Jae-Dol Kim and Kwang-Seok Lee

Pukyong National University, South Korea

*Abstract*—On some machines using refrigerant like domestic air conditioner, air handling unit

and industrial chiller, it has released the refrigerant inside of the machines to the air when it needs repair or disposal. However using freon refrigerants such as CFC, HCFC, HFC, etc. effect on global warming seriously, and will be banned after 2030 years at all by Montreal Protocol. Therefore, to retrieve the refrigerants from the machines is becoming mandatory. [1~3] This means that demands of both refrigerant retrieval system and refinery system for reusing the retrieved refrigerant is increasing, and this demands are expected to increase continuously. Former refrigerant retrieval machine takes long time to retrieve refrigerant and is inappropriate to apply to working place, because it is the way to retrieve vapor refrigerant by using compressor. This research improves the retrieval time by collecting the refrigerant amount of 95% as liquid state, and saves 50% energy compared with former retrieval way to use additional electric heater by utilizing refrigerant condensation heat. The system is made of heat pump which consist of evaporator, condenser, compressor and expansion valve and refrigerant storage tank with capacity of 1.5tons. The refinery capacity is 200kg per hour, so to find proper heat exchanger and to minimize proportion of oil in refined refrigerant are major points. In the collected refrigerant the oil in the machines is contained, so elimination of the oil below 1% is one of research purposes to refine over 99% purity.

### **G3001-a Poster Presentation 3**

Heat transfer characteristics on a new type of photovoltaic/thermal system with a rectangular turbulence promoter

H.U. Choi, R. Fatkhur, J.R. Kim, Y.B. Kim, C.H. Son, J.I. Yoon, **K.H. Choi**

Pukyong National University

*Abstract*—A PV/T system means photovoltaic/thermal system. It consists of the photovoltaic module and solar thermal collectors that can obtain both electrical power and thermal energy from the solar radiation by attaching heat recovery system such as liquid tube or air duct to traditional photovoltaic module. Thus, power generation of photovoltaic module can be increased by decrement of the module temperature and thermal energy retrieved from the module by the liquid. The recovered air also can be used for space heating and so on. At this time, thermal performance of air type PV/T system can be improved by installing turbulence promoter in the air channel and many researches related to improving thermal performance by settling the turbulence promoter have been already studied. As part of these researches, heat transfer and pressure drop characteristics in air channel of air type PV/T system was investigated in this research according to the numerical analysis method. As a result, heat transfer performance was enhanced around 1.8 times by different installation distance of rectangular turbulence promoter compared to the plain duct. The pressure drop, however, was increased averagely 13 times for rectangular turbulence promoter. It was confirmed that the optimal installation distance of rectangular turbulence promoter in air channel of air type PV/T system can also influence its pressure drop as well as heat transfer enhancement.

*Acknowledgments*

Following are results of a study on the “Leaders in Industry-university Cooperation+” Project, supported by the Ministry of Education and National Research Foundation of Korea

### **G3002-a Poster Presentation 4**

Supercritical Cooling Heat Transfer Characteristics of CO<sub>2</sub> in a Gas Cooler

**Chang-Hyo Son**, Kwang-Hwan Choi, Suk-Ho Jung, Ji-Won Yoon, Min-Ju Jeon, Joon-Hyuk Lee

Pukyong National University

*Abstract*—In natural refrigerants, CO<sub>2</sub> has small atmospheric concentration on the solution to the human (TVL, Threshold Limit Value) compared to the ammonia, and unlike HC refrigerants, CO<sub>2</sub> is non-flammable and non-toxic and inexpensive. Furthermore, since CO<sub>2</sub> has a high operating pressure in the application temperature range, the system can be miniaturized and its utilization is high. In addition, the capacity per unit volume of refrigerant (VCR, Volumetric Capacity for Refrigerants) is superior to conventional refrigerants. Because the vapor pressure is about 7 times higher than that of R22, the VCR is further increased and therefore the possibility of reducing the size of the system is possible [1~3]. The purpose of this paper is to provide data about the performance of heat transfer and basis resource for the optimal design of a refrigeration and air conditioning system that uses CO<sub>2</sub> as a working fluid to replace the Freon refrigerant. For this paper, a system is composed of a refrigerant pump, a preheater, an evaporator, and a gas cooler and a double-tube heat exchanger which has inner diameter of 7.75 mm was used for the gas cooler. To understand the heat transfer characteristics of the gas cooler, the temperature distribution of refrigerant, cooling water, and tube was examined and gas cooling characteristics were analyzed according to the heat flux, mass flow rate and saturation temperature. Based on this, we propose a new correlation formula to provide basic design data of gas cooler using CO<sub>2</sub> which is natural refrigerant.

### **G0021 Poster Presentation 5**

Immobilization of isocitrate dehydrogenase on mesoporous silica foam for carbon dioxide capture

**Shunxiang Xia**, Laibao Zhang, Enjelia Veony

University of Minnesota

*Abstract*—Carbon capture can be realized effectively through isocitrate dehydrogenase reaction and the reaction rate was strongly affected by the environmental parameters such as pH and temperature. Enzyme immobilization was conducted to improve the enzyme stability during the capture process. By simply adsorbing enzyme on the surface of mesoporous silica foam, enzyme stability against temperature, pH and shear stress was improved. The immobilization process can be completed in 5 mins, and 0.87 U enzyme activity was kept for each gram of immobilization material. After 10 cycles, more than 50 percent of enzyme activity remained. The reusability and improved stability made immobilized ICDH a better candidate for large-scale application of carbon capture.

### **K0007-a Poster Presentation 6**

Analysis of the Changes in the IDF Curve for Temporal Resolution

**Kim, Kyungmin**, Kim, Sangdan

Division of Earth Environmental System, Pukyong National University, Busan, South Korea.

*Abstract*-Recent domestic researches on the future design rainfall have been conducted by applying various temporal downscaling techniques based on daily temporal resolution data produced from Regional Climate Model (RCM) provided by Korea Meteorological

Administration (KMA) and CORDEX. However, no matter what temporal downscaling techniques are applied, many assumptions are needed in the process of estimating the design rainfall for sub-daily duration from daily rainfall time series. In this study, we investigated the effect of RCM temporal resolution on the estimation of future IDF curves. For this purpose, temporal resolution 3-hour and 24-hour rainfall data were constructed using observed hourly rainfall time series of KMA of Busan station. And, the derived IDF curves were compared with the IDF curve derived from temporal resolution 1-hour rainfall time series, respectively. As a result, it was confirmed that the IDF curve derived from the temporal resolution 3-hour rainfall data reproduces the IDF curve derived from the observed hourly rainfall time series better. Also, future IDF curves were derived from temporal resolution 3-hour future rainfall time series that dynamically downscaled at Busan station using RCM(MM5), general climate model MPI-PSM-LR driven by RCP 8.5 scenario. Finally, the effect of RCM's temporal resolution on the estimation of future IDF curves was analyzed by comparing with the future IDF curve derived from temporal resolution 3-hour and 24-hour future rainfall time series.

### **K1001-a Poster Presentation 7**

Retrospect and Prospect of Soil and Groundwater Bioremediation in Taiwan

**Chun-chi Lai**, Chia-Che Lee, Shyh-Wei Chen, I-Hsing Chen

Environmental Protection Administration, Executive Yuan. No. 83, Zhonghua Rd. Sec. 1, Zhongzheng District, Taipei, Taiwan

*Abstract-* EPA of Taiwan has started to select one groundwater contaminated site respectively at the northern and southern part of Taiwan since 2013 to carry out in-situ enhanced bio-remediation. The remediation for groundwater contaminated by chlorinated solvents includes methods like double packer injection method and direct mixing. To improve the remediation at the sites in National Priority List, a comprehensive groundwater improving operation has been started after confirmed the feasibility. EPA has also made the provision of funds since 2010 to reward each researching institution for developing investigation and remediation technologies, and the researching has gradually reaching the practical demands. Under the prevention and investigation for soil and groundwater contamination in almost 20 years, EPA suggests developing the speeded investigation for molecular bio-technology as a short-term to mid-term priority such as biological immunoassay and molecular bio-technology. The in-situ soil remediation includes Bioventing, Enhanced Bioremediation, and Phytoremediation; the ex-situ soil remediation includes Biopiles, Composting, Landfarming, and Slurry phase biological treatment. The in-situ groundwater remediation includes Enhanced Bioremediation, Monitored Natural Attenuation, and Phytoremediation; the ex-situ groundwater remediation includes Bioreactors, et cetera.

### **G0041 Poster Presentation 8**

Sliding mode control of biogas production by anaerobic digestion with addition of acetate

**Plamena Zlateva**

Institute of Robotics, Bulgarian Academy of Sciences, Acad. G. Bonchev Str., Bulgaria

*Abstract-* Biogas production by anaerobic digestion with addition of acetate is considered. Sliding mode control for regulation of the biogas flow rate using the addition of acetate as a

control action is proposed. The control design is carried out with direct use of nonlinear model and expert knowledge. Chattering phenomena are avoided by realizing the sliding mode with respect to the control input derivative. The state variables, external disturbance, process output and control input are varied in the known intervals. The performance of the designed sliding mode control is investigated by varying the process set point and the uncertain process parameter, which reflecting the influence of the external disturbance. The excellent performance of presented control is proved through simulation investigations in *MATLAB* using *Simulink*.

### **K0014-a Poster Presentation 9**

Qualitative Study for Plastic Microbeads in Personal Care and Cosmetics Products

**Dong, Tzu-Tong, Jin, Siao-Yi, Kuo, An-Fu**

Environment Analysis Laboratory, EPA Executive, Taiwan

*Abstract-* In order to facilitate exfoliation and cleaning, enterprises have commonly added solid plastic microbeads to personal care and cosmetics products based on considerations of product cost and product function and effectiveness. However, since solid plastic microbeads possess the characteristics of small size, small mass, and large quantity, after they are rinsed off, they cannot be effectively collected, removed, or disposed of, and consequently enter water bodies and the environment via the sewage collection system. In the marine environment, the microbeads readily adsorb harmful substances and may accumulate within the bodies of aquatic organisms, causing harm to the environment and ecosystem. The study was collected 39 kinds of brand-name products for people's livelihood such as facial cleanser, shower gel and toothpaste from supermarkets in Taiwan. After pretreatment, the samples were analysed by FTIR and Raman Spectroscopy to identify the components of the plastic particles added to the product. The results showed that all of the products containing the particulate component were polyethylene (PE). This study confirming that the analysis method has a rapid and effective identification capability.

### **Dinner**

**18:00**

**Restaurant of Sapporo Kitahiroshima Classe Hotel**



## List of Listeners

<b>Name</b>	<b>Affiliation</b>
Bandar Al-Mur	King Abdulaziz University, Saudi Arabia
Xiao Hong	Institute of Applied Ecology, Chinese Academy of Sciences, China
Chang, Chih-Hao	Environmental Protection Administration, Executive Yuan. No. 83, Zhonghua Rd. Sec. 1, Zhongzheng District, Taipei, Taiwan 10042, R.O.C.
Abdulhaleem Labban	King Abdulaziz University, Saudi Arabia
Moon-Soo Kim	Hankuk University of Foreign Studies, Republic of Korea



## One Day Visit

**August 29, 2018 (Wednesday)**

**9:00--17:00**

**9:00: Assemble at the outside of Seisa Dohto University**

**9:30: Depart from the Seisa Dhoto University by bus.**

**10:00: Historical Museum of Hokkaido**

<http://www.kaitaku.or.jp/info/info.htm>

Hokkaido Museum (北海道博物館 Hokkaidō Hakubutsukan) opened in Sapporo, Hokkaidō, Japan in 2015. Located within Nopporo Shinrin Kōen Prefectural Natural Park, the permanent exhibition is dedicated to the nature, history, and culture of Hokkaido. Also known as Mori-no-Charenga (森のちゃれんが), the museum integrates and replaces the Historical Museum of Hokkaido (北海道開拓記念館), which opened in 1971, and the Hokkaido Ainu Culture Research Centre (北海道立アイヌ民族文化研究センター), which opened in 1994.

**12:00: Lunch at the Emicia (in the hotel near the Shin Sapporo station).**

**13:00: Maruyoshi (Eco-friendly Company in Hokkaido)**

**17:00: Arrive at the Seisa Dhoto University**

**Kitahiroshima** (北広島市 *Kitahiroshima-shi*) is a city located in Ishikari, Hokkaido, Japan. "Kita" is the Japanese word for "north", so the town's name, *Kitahiroshima-shi*, is translated as "North-Hiroshima city" or "city of North-Hiroshima".











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