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WELCOME MESSAGE

It is a great pleasure to hold the 4th EnvironmentAsia International Conference in Chulalongkorn University, Bangkok Thailand, from June 21-23, 2017.

The Thai Society for Higher Education on Environment (TSHE) was founded in 2005 and aims to enhance the quality and reference of educational and training in environmental inter-discipline programs to apply in policy and leadership development in the area of natural resources and environment and to enhance the capacity and sustainability of environmental system. TSHE has continuously organized the international conference every two year since 2011. The conference will bring together scientists, experts, policy makers, researchers and students to discuss and address the issues of the environment together with building international networks and cooperation for an environmentally sustainable world.

This year 2017 conference in particular, has more activities than previous meetings. We organized seven concurrent sessions, two panel discussions including one round table discussion. Several well-known scholars and researchers have been invited. This year's theme

"Practical Global Policy and Environmental Dynamics" is closely linked with the international agreement and policy such as COP21, New York declaration on Forest, climate change adaptation, transboundary pollution management etc. It is a matter that how we can make the global policy work in the environmental changing which we are going to find out in this meeting.

On behalf of the Thai Society of Higher Education Institutes on Environment (TSHE), I am delighted to welcome all active participation.

Sincerely,

Assistant Professor Dr. SITTIPONG DILOKWANICH
President of TSHE

MESSAGE FROM CHULALONGKORN UNIVERSITY

On behalf of Chulalongkorn Univer sity, I would like to welcome all of you to the The 4th EnvironmentAsia 2017: “Practical Global Policy and Environmental Dynamics”, an international conference of The Thai Society for Higher Education on Environment (TSHE) in collaboration with the consortium of Thai Universities.

We are very pleased and proud to host this conference in Chulalongkorn University. Particularly, this year the year 2017, is Chulalongkorn University’s 100th anniversary. This international conference organizing will anticipate in our centennial celebrations and pay homage to the late King Bhumibol Adulyadej for his contributions to the university’s advancement.

Chulalongkorn University encourages all faculty staff to establish high quality academic activities including teaching, learning, researches as well as academic services of international conference.

I would like to congratulate TSHE on this successful important international conference with many participants from policy makers to academicians, researchers and students both domestic and international and this will lead to exchange of knowledge and experiences in the area of environmental science, environmental health, environmental engineering and environmental management within the country, ASEAN Economic Community and the world.

Once again, on behalf of Chulalongkorn University, I would like to thank all supporters of this International Conference including sponsors, lecturers, participants and staff of Department of Environmental Science and TSHE for making this conference happen and hope that this conference will be fruitful and very successful one.

Sincerely,

Professor Dr. BUNDHIT EUA-ARPORN
President of CHULALONGKORN UNIVERSITY

MESSAGE FROM CONFERENCE CHAIR

Dear colleagues/participants,

On behalf of the 4th EnvironmentAsia International Conference Chair, organizing and scientific committee, I would like to welcome you to Bangkok Thailand. In this conference we have many honorable guests and outstanding invited speakers. The theme of this year's conference, titled the "Practical Global Policy and Environmental Dynamics", covers one special keynote speech, two panel discussions, 12 invited papers, and one round table meeting. This conference goes to the heart of five scientific sessions relating to the Environmental science and technology, Natural Resources Management, Disaster and Sustainability, Environmental health and education, and Environmental management. There are more than 100 paper submissions and more than 200 participants attending this conference from various nations, including group registration from Vietnam and the Independent Commission on Environment and Health (ICEH).

We hope that you will take up the challenges and opportunities that arise, give your professional development a big push, ask those burning questions and enjoy presenting your work to peers. Please also check out the exhibitions, posters and support our sponsors.

Most of all, I would like to thank the members of the organizing team and the Thai Society for Higher Education on Environment (TSHE) committee, colleagues, staff and volunteers for their tireless efforts to organize this conference.

However, the success of the conference now depends on your participation and your contribution in both presentation and exchanging the ideas. I encourage you to experience as much as you can, to meet new colleagues, to debate scientific perspectives and of course to take some time to visit Thailand's cultural and exotic places.

Once again, welcome to Thailand and to the 4th EnvironmentAsia International Conference.

Sincerely,

Professor Dr. WANIDA JINSART
Chair of CONFERENCE and TSHE PRESIDENT ELECT

OPENNING REMARK

It is my great honor and delight to greet you all, and to particularly extend a warm welcome to the distinguished guests from abroad. Please enjoy your time in Thailand, the land of smile.

The theme of this 4th EnvironmentAsia International Conference echoes the call for international cooperation for the solution of international environmental problems and for an environmentally sustainable world. It is questionable that can we change our perception of economic competition into socioeconomic collaboration for vibrant global ecological system, and how can we have the practical global policy coping with environmental dynamics? This issue is then leading to the arrangement of international conference of the 4th EnvironmentAsia, during 21-23 June 2017 Bangkok, Thailand.

Since 1970s, the United Nations has launched a number of conventions, protocols, and agenda concerning pollution, environmental change, and natural resource depletion. Conventions and protocols of Stockholm, Basel, Cartagena, and Rio de Janeiro, for examples, are prime policies for many countries to follow in order to raise public awareness and mitigate environmental problems facing humanity. However, mutual interest among member countries for environmental security does not agree to different social and economic conditions of each country. Environmental problems in many countries have also become more and more troublesome, resulting from transforming of traditional agronomic societies to industrialized developing countries. Global environmental damages such as climate change, over exploitation of marine fishery resources, oil spills, and water pollution have detrimental impacts on economic environmental and societal well-being. To solve the environmental problem, end of pipe solutions have been suggested and employed for poverty eradication, illiteracy, pollution control, and environmental management which is mainly based on technological innovation of developed countries. Nevertheless, the prevention of environmental problems has been loosely implemented and collaborated. Although most countries realized that they have heavily exploited natural resources and generate unwanted wastes which cause loss of biodiversity, global warming, coastal erosion and etc., the natural resources around the world still have been exploited rapidly due to over-production and over-consumption. This reflected on the difficulty

OPENNING REMARK

of making the policy into action. For example, there are many global agreements, convention and declaration on forest sustainability which hopefully will solve the problem of deforestation.

We are indeed convinced that acting collectively can bring about effective and wide scale change, based on addressing the recurrent threats and degradation of the environment and natural resources, and on mobilizing individuals, organizations and governments to actively participate in that effort. Our submission is that we all have to strive for a world of equal opportunities, one that is efficiently dynamic, productive, and respectful of its natural assets to provide for our current well-being, and that of the future generations. To succeed in this endeavor requires every single nation on earth to take concrete actions and work together for the Environment.

Ladies and gentlemen, this conference is the international platform for exchanging ideas and experiences as well as introducing new technology, advancement and innovation in the fields of environmental science and technology, disaster and sustainability, natural resource management, environmental health and education, and environmental management.

I wish to use this opportunity to express on behalf of the Ministry of Natural Resources and Environment, our most sincere gratitude to all participants of this conference. My appreciation equally goes to the Thai Society of Higher Education Institutes on Environment for their invaluable involvement in the preparation and the holding of this important Conference.

It is now an honor and privilege to declare officially open the Conference on Practical Global Policy and Environmental Dynamics and I wish you fruitful deliberations.

Thanks for your very kind attention

Dr. WIJARN SIMACHAYA
Permanent Secretary of
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

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Chulalongkorn University

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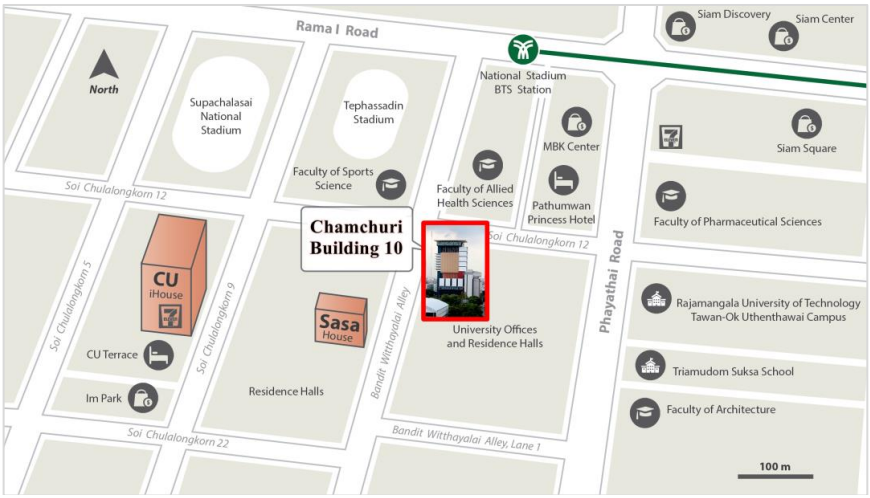
Dr. Pasicha Chaikaew
Chulalongkorn University

Assistant Professor Dr. Rattapon Onchang
Silpakorn University

Assistant Professor Dr. Panwadee Suwattiga
Burapha University

VENUE MAPS

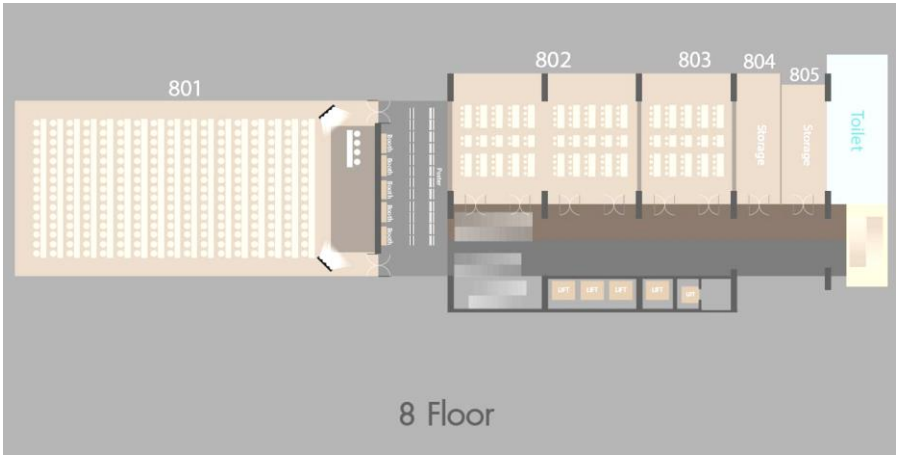
CONFERENCE VENUE
AT CHAMCHURI BUILDING 10, BANGKOK, THAILAND



VENUE MAPS

CONFERENCE ROOMS
AT CHAMCHURI BUILDING 10, BANGKOK, THAILAND

FLOOR 8TH



Wednesday, 21 June 2017

Room 801	Opening Ceremony	
	Session I	Environmental Science and Technology
Room 802	Session I*	Environmental Science and Technology
Room 803	Session III	Disaster and Sustainability

Thursday, 22 June 2017

Room 802	Session IV	Environmental Education and Health
Room 801	Session I	Environmental Science and Technology
	Closing Ceremony	

VENUE MAPS

CONFERENCE ROOMS
AT CHAMCHURI BUILDING 10, BANGKOK, THAILAND

FLOOR 7TH

Wednesday, 21 June 2017

Room 701	Session II	Natural Resources Management
Room 702	Session V	Environmental Management Tools

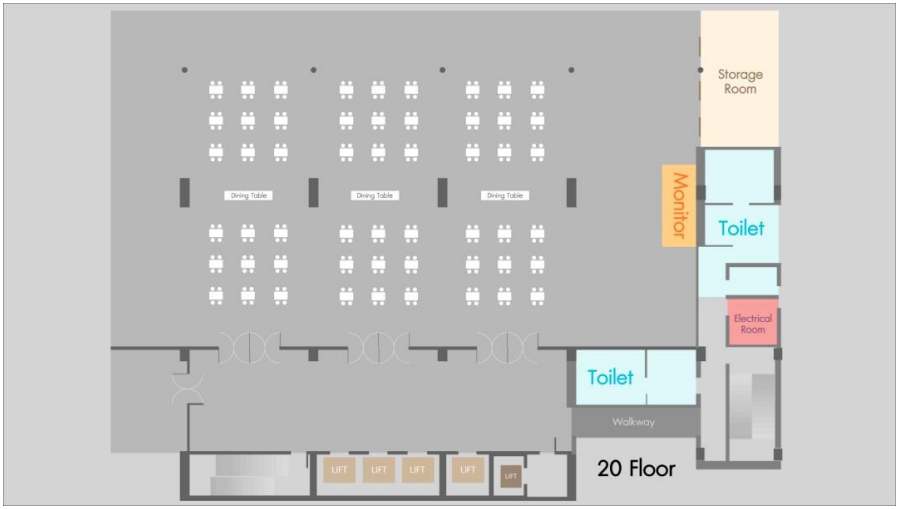
Thursday, 22 June 2017

Room 701	Session II	Natural Resources Management (13.00–14.30)
	Session III	Disaster and Sustainability (14.30–15.40)
Room 702	Round Table Session	

VENUE MAPS

CONFERENCE ROOMS
AT CHAMCHURI BUILDING 10, BANGKOK, THAILAND

FLOOR 20TH for Lunch



CONFERENCE PROGRAMS

Wednesday, 21 June 2017

8.00 – 9.00	**REGISTRATION**
9.00 – 9.30 **Room 801**	**Opening ceremony** **Welcome remarks** **Prof. Dr. Bundhit Eua-arporn** President of Chulalongkorn University **Asst. Prof. Dr. Sittipong Dilokwanich** President of Thai Society of Higher Education Institutes on Environment **Opening remarks** **Dr. Wijarn Simachaya** Permanent Secretary, Ministry of Natural Resources and Environment, Thailand
9.30 – 10.00 **Room 801**	**Keynote speech** on Global Environmental Dynamics and Policy Challenges By **Dr. Surin Pitsuwan,** Special advisor, Economic Research Institute for ASEAN and East Asia MC: **Dr. Pasicha Chaikaew**, Chulalongkorn University **Mr. Tin Thongthammachart**, Chulalongkorn University
10.00 – 10.30	REFRESHMENT
10.30 – 12.00 **Room 801**	**Special topics** on Environmental Policy: Implication and Cooperation **Mr. Jonathan Gilman** UN Environment representative, United Nations Environment Program **Dr. Nawarat Krairaparnond** Natural Resources and Environmental Policy and Planning Expert, Office of Natural Resources and Environmental Policy and Planning **Mr. Mike Mannaart** Executive Secretary at KIMO the Netherlands and Belgium **Prof. Dr. Freek van der Meer** University of Twente, the Netherlands Moderator: **Major Pongsakorn Kaewkornmaung** Chulachomklao Royal Military Academy
12.00 – 13.00	LUNCH
13.00 – 16.25	**Oral presentation** *Session I Environmental Science and Technology, Room 801* *Session II Natural Resources Management, Room 701* *Session III Disaster and Sustainability, Room 803* *Session I* Environmental Science and Technology, Room 802* *Session V Environmental Management Tools, Room 702*
16.25 – 17.30	**Poster presentation** I-1-P, I-2-P, I-4-P, I-5-P, I-8-P, I-9-P, I-10-P, I-11-P, I-12-P, I-14-P, I-16-P, I-18-P, I-19-P, I-20-P, I-21-P
18.00 – 20.00	**CONFERENCE DINNER AT SALA THAI**

CONFERENCE PROGRAMS

Wednesday, 21 June 2017

Oral Presentation Session I — Room 801

Environmental Science and Technology

Session chair: Prof. Dr. Masaki Hosomi

Co- chair: Dr. Vorapot Kanokkantapong

13.00 – 13.30	**Special Talk**	
	I-1-i	**Prof. Dr. Thares Srisatit** Rehabilitation Approach of Klity Creek Contaminated with Lead, Kanchanaburi Province, Thailand
13.30 – 13.50	**I-1-O**	Environmental Performance and Optimization Approaches of Aluminum and Beech Wood Window Frames
13.50 – 14.10	**I-2-O**	Coconut Shell Activated Carbon with βeta-Silicon Carbide Reinforced Polymer Composites: An Alternative Dielectric Material for Microwave Absorber
14.10 – 14.30	**I-3-O**	Evaluation of Greenhouse Gas Emissions from Municipal Solid Waste (MSW) Management: Case Study in Lampang, Thailand
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.00	**I-4-O**	Estimation of Air Temperature from Thermal Images by Low Flying and Shade Effect of Tree Crown for Mitigating Urban Thermal Circumstances
15.00 – 15.20	**I-5-O**	Impact of Acid Deposition on Plankton Population Variability in the Bangphra Reservoir Water Supply, Chonburi Province, Thailand
15.20 – 15.40	**I-9-O**	Health Risk Assessment of Nitrogen Dioxide and Sulfur Dioxide Exposure from a Developing Coal Power Plant in Thailand
15.40 – 16.00	**I-13-O**	Predicting Energy Consumption Using Artificial Neural Network (ANN): A Case Study in a Cold Store in the North Island of New Zealand

CONFERENCE PROGRAMS

Wednesday, 21 June 2017

Oral Presentation Session I+ — Room 802

Environmental Science and Technology

Session chair: Dr. Mike Le Duc

Co- chair: Asist. Prof. Dr. Ratcha Chaichana

13.00 – 13.30	**Special Talk**	
	I+-1-i	**Assoc. Prof. Dr. Yoshimura Chihiro** Applicability of Carbon Nanotubes for Removing Toxic Organic Compounds from Effluent Water
13.30 – 13.50	**I+-1-O**	Effect of Acid-Alkaline and Thermal Pretreatment on Cassava Pulp Feed Batch Reactors in Optimization of Bio-Methane Yield
13.50 – 14.10	**I+-3-O**	Impact of Land-use Activities on Surface Water Quality in the Pazuntaung Creek, Myanmar
14.10 – 14.30	**I+-4-O**	Reproductive Toxicity and Acetylcholinesterase Inhibition of Profenofos on Japanese Medaka, *Oryzias latipes*
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.00	**I+-5-O**	The Measurement of Nitrous Oxide Emission from Maize Cultivation
15.00 – 15.20	**I+-6-O**	The Effect of Steam and Glycerol Pretreatment on Chemical Contents of Oil Palm Empty Fruit Bunch (EFB)
15.20 – 15.40	**I+-7-O**	Emission Factors of Particulate Matter PM_{10} and $PM_{2.5}$ from Open Burning of Corn Stover in Thailand
15.40 – 16.00	**I+-8-O**	Synthesis of Calcium Oxide from River Snail Shell to A Catalyst In The Production of Biodiesel

CONFERENCE PROGRAMS

Wednesday, 21 June 2017

Oral Presentation Session II — Room 701

Natural Resources Management

Session chair: Prof. Dr. S.W. Edward

Co- chair: Dr. Pasicha Chaikaew

13.00 – 13.30	**Special Talk**	
	II-1-i	**Dr. Woranuch Emmanoch** A New Challenge of Forest Role in Attacking Climate Change
13.30 – 13.50	**II-1-O**	Spatial Heterogeneity of Heavy Metals and Risk Assessments in the Mae Klong River Estuarine Ecosystem
13.50 – 14.10	**II-3-O**	Spatial and Temporal Variation of Seawater Qualities and Indigenous Benthos along the Northern Gulf of Thailand from Chonburi to North Pattaya
14.10 – 14.30	**II-4-O**	Gastrointestinal Parasitic Species of Gaur (*Bos gaurus*) and Native Breed Cattle (*Bos taurus indicus*) between Transition Zones of Conservation Area in the Northeast, Thailand
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.00	**II-6-O**	Distribution of Mercury in Water, Suspended Solid and Sediment in Chao-Phraya River Mouth Area
15.00 – 15.20	**II-7-O**	Seasonal and Land Use Effects on Amphibian Abundance and Species Richness in the Sakaerat Biosphere Reserve, Nakon Ratchasima
15.20 – 15.40	**II-11-O**	Differentiation of Mangrove Ecosystem alongside of River Bank along Same Latitude in Ayeyarwaddy Delta Coastal Zone, Myanmar

CONFERENCE PROGRAMS

Wednesday, 21 June 2017

Oral Presentation Session III — Room 803

Disaster and Sustainability

Session chair: Prof. Dr. Freek van der Meer

Co- chair: Assist. Prof. Dr. Soontree Khuntong

13.00 – 13.30	**Special Talk**	
	III-1-i	**Assoc. Prof. Dr. Jiro Takemura** Case Studies of Major Solid Waste Landfills in Thailand, Cambodia and Laos– Leachate and its effects of Surface Water and Groundwater Environments
13.30 – 13.50	**III-1-O**	An Assessment of Climate Variability on Farmers' Livelihoods Vulnerability in Ayeyarwady Delta of Myanmar
13.50 – 14.10	**III-2-O**	PM_{10} and $PM_{2.5}$ from Haze Smog and Visibility Effect in Chiang Mai Thailand
14.10 – 14.30	**III-3-O**	Flash Flood Risk Estimation of Wadi Qena Watershed, Egypt Using GIS Based Morphometric Analysis
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.00	**III-4-O**	Age and Evolution of Beach Ridge Plain from Chaiya Coast of the Gulf of Thailand
15.00 – 15.20	**III-5-O**	Morphometric Temporal Change Analysis for the River Nile Forced Bends using RS/GIS Techniques: Case Study of Damietta Branch of the Nile River, Egypt
15.20 – 15.40	**III-6-O**	Investigating Reef Contact Rates of Snorkel Visitors at Koh Sak, Pattaya on Guided and Non-Guided Coral Reef Tours
15.40 – 16.00	**III-10-O**	Health Survey of Primary-school Children in the Vicinity of a Sanitary Landfill in Nonthaburi, Thailand

Wednesday, 21 June 2017

Oral Presentation Session V — Room 702

Environmental Management Tools

Session chair: Assoc. Prof. Dr. Kraichat Tantrakarnapa

Co- chair: Dr. Chuthamat Rattikansukha

13.00 – 13.30	**Special Talk**	
	V-1-i	**Prof. Kunio Kawamura** A Powerful Research Tool for Screening and Development of Solid-state Catalysts Building up the Environment Harmless Chemical Technologies
13.30 – 13.50	**V-1-O**	The Results of Public Participation Process for the Compensation of the Socio and Environmental Impact of a Crude Oil Leak Samet Island Rayong Province
13.50 – 14.10	**V-2-O**	Non-formal Leaders as Intermediates for the Creation of Environmentally aware Behavior with Regard to Arsenic Contamination of Surface Water from the Klongkram Watershed, Tha Utae Sub-district, Kanchanadit District, Surat Thani Province
14.10 – 14.30	**V-3-O**	Public Participation in Environmental Impact Assessment of Real Estate Development Projects in Nakhon Ratchasima, Thailand
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.00	**V-4-O**	The Impact of Land Use Land Cover Change on Ecosystem Services in the border zone of Kasungu National Park, Malawi
15.00 – 15.20	**V-5-O**	Effects of ZnO Nanoparticle on Plant Growth, Plant Stress, Zn Bioaccumulation in Water Hyacinth (*Eichhornia crassipes*)
15.20 – 15.40	**V-6-O**	Natural Radioactivity in Groundwater in Phra Nakhon Si Ayutthaya Province
15.40 – 16.00	**V-7-O**	An application of Geographic Information Systems for Wastewater Management Based on Land Use Characteristic in Chonburi Province
16.00 – 16.20	**V-8-O**	Environmental Health Impact Assessment and its Defects in Thailand

CONFERENCE PROGRAMS

Thursday, 22 June 2017

08.00 – 09.00	REGISTRATION
09.00 – 11.00 **Room 801**	**Special topics on "Environmental Dynamics"** **Panelists:** **Prof. Dr. Akira Kondo** Osaka University **Acting sub Lt. Surapon Duangkhae** Vice chairman, Independent Commission on Environment and Health **Dr. Sarah Clement** Geography and Planning, School of Environmental Sciences,The University of Liverpool **Prof. Dr. Chongrak Polprasert** Environmental Engineering, Thammasat, University **Moderator: Prof. Dr. S.W. Edwards** The University of Liverpool
11.00 – 11.15	REFRESHMENT
11.15 – 12.00	**Poster presentation** II-2-P, II-5-P, III-1-P, IV-1-P, IV-12-P, IV-13-P, IV-15-P, IV-16-P, IV-18-P, IV-19-P, IV-20-P
12.00 – 13.00	LUNCH
13.00 – 16.00	**Oral presentation** *Session I Environmental Science and Technology, Room 801* *Session II Natural Resources Management, Room 701 (first half 13.00 – 14.30)* *Session III Disaster and Sustainability, Room 701 (second half 15.00 – 16.00)* *Session IV Environmental Education and Health, Room 802* *Round Table Session, Room 702*
16.00 – 16.20	**Presentation evaluation**
16.30 – 17.30 **Room 801**	❖ **Announcement of young researcher award and poster award winner** ❖ **Closing remarks by President of TSHE**

CONFERENCE PROGRAMS

Thursday, 22 June 2017

Oral Presentation Session I — Room 801

Environmental Science and Technology

Session chair: Assoc. Prof. Dr. Akihiko Terada

Co- chair: Assoc. Prof. Dr. Pongsak Noophan

	Special Talk	
13.00 – 13.30	**I-2-i**	**Assoc. Prof. Dr. Akihiko Terada** Membrane-Aerated Biofilm Reactors for Nitrogen Removal and Mitigation of Nitrous Oxide Emission from Wastewater Streams
13.30 – 13.50	**I-6-O**	Estimation of Leachate Generated from Zimbabwe's Municipal Solid Wastes (MSW) Landfills Using a Simple Stochastic Water Balance Model
13.50 – 14.10	**I-7-O**	Mass Balance of Hydrogen Cyanide and Hydrogen Sulfide Gases Removal by Dual Fixed-Film Bioscrubber
14.10 – 14.30	**I-8-O**	Batch Reactor Design for Algal Biosorption of Mercury-Contaminated Acidic Water
14.30 – 14.40	**REFRESHMENT**	
14.40 – 15.10	**Special Talk**	
	I-3-i	**Prof. Dr. Tsuyoshi Kinouchi** Preparing for Extreme Droughts and Floods in Southeast Asian Countries
15.10 – 15.30	**I-10-O**	Nutrient Removal Performance on Domestic Wastewater Treatment Plants (Full Scale System) between Tropical Humid and Cold Climates
15.30 – 15.50	**I-11-O**	Adsorption of Cadmium (II) Ions from Synthetic Wastewater onto Fly Ash

CONFERENCE PROGRAMS

Thursday, 22 June 2017

Oral Presentation Session II — Room 701

Natural Resources Management

Session chair: Mr. Mike Mannaart

Co- chair: Assist. Prof. Turenjai Doolgindachbaporn

13.00 – 13.30	**Special Talk**	
	II-2-i	**Mr. Mike Mannaart** How to Actively Engage Society in Environmental Policy and Management: The Dutch "Green Deal Approach" as an Example of Addressing Effectively the Prevention of Littering and the Removal of Litter in the Coastal and Marine Environment
13.30 – 13.50	**II-8-O**	Contribution of Root Respiration to Soil Respiration during Rainy Season in Dry Dipterocarp Forest, Northern Thailand
13.50 – 14.10	**II-9-O**	Pollution Status and Potential Ecological Risk Assessment of Heavy Metals in Soils from a Municipal Solid Waste Open Dumpsite in Thailand
14.10 – 14.30	**REFRESHMENT**	

Oral Presentation Session III — Room 701

Disaster and Sustainability

Session chair: Assoc. Prof. Jiro Takemura

Co- chair: Assist. Prof. Dr. Panwadee Suwattiga

14.30 – 15.00	**Special Talk**	
	III-2-i	**Assoc. Prof. Dr. Tamao Kasahara** Effects of Headwater Dams on Organic Matter Decomposition in the Stream Channel and the Hyporheic Zone
15.00 – 15.20	**III-8-O**	Assessing the Sustainability of Ghanaian Cities: the case study of Accra Metropolitan Area
15.20 – 15.40	**III-9-O**	The Use of Dredged Sediment from the Watsongpeenong Canal with Paper Mill Residue to Produce Facing Bricks

CONFERENCE PROGRAMS

Thursday, 22 June 2017

Oral Presentation Session IV — Room 802

Disaster and Sustainability

Session chair: Prof. Surasak Taneepanichskul, MD

Co- chair: Assist. Prof. Dr. Siranee Sreesai

13.00 – 13.30	**Special Talk**	
	IV-1-i	**Prof. Eiji Yano, MD** Practical Global Policy and Environmental Dynamics: Case Study in Environmental Epidemiology
13.30 – 13.50	**IV-1-O**	Model of Sustainable Wellbeing Integrated with Environmental Education for Agriculturist
13.50 – 14.10	**IV-2-O**	Health Risk Assessment of PM_{10} and $PM_{2.5}$ in Chiang Mai, Thailand
14.10 – 14.30	**IV-4-O**	Efficacy of Integrated Method between Gravid Aedes Trap (GAT) and Space Spray for Controlling Dengue Vectors in Bangkok
14.30 – 14.50	**REFRESHMENT**	
14.50 – 15.20	**Special Talk**	
	IV-2-i	**Prof. Kunio Hara, MD** A Comparison of Chronological Changes in PM10 Concentrations in Four Asian Mega-Cities
15.20 – 15.40	**IV-7-O**	Adverse Birth Outcomes among Infants Born to Women Living near a Sanitary Landfill Site in Nonthaburi, Thailand
15.40 – 1	**IV-8-O**	Respiratory Hospitalizations of Children Living near a Sanitary Landfill in Nonthaburi, Thailand: a Case Control Study

CONFERENCE PROGRAMS

Thursday, 22 June 2017

Round Table Session — Room 702

Environmental Management Tools

Session chair: Acting sub Lt. Surapon Duangkhae
Co- chair: Dr. Thanomsak Boonphakdee

13.00 – 13.30	**Special Talk** **Dr. Thanawat Imsomboon**
13.30 – 14.30	**Round Table**
14.30 – 15.00	**REFRESHMENT**
15.00 – 16.00	**Round Table**

Friday, 23 June 2017

Excursion

09.00 – 16.00	**The Grand Palace in Bangkok** including Wat Phra Kaew (Temple of the Emerald Buddha) **Ananta Samakhom Throne Hall** Bangkok Palaces and Mansions **Bang Pa-In Royal Palace** The Royal Summer Residence near Ayutthaya

KEYNOTE LECTURER

Professor Emeritus Dr. Surin Pitsuwan

"Practical Global Policy and Environmental Dynamics"

Biography:

Professor Dr. Surin Pitsuwan, born on 28 October 1949, is a native of Nakorn Sri Thammarat, Southern Thailand. He received his primary and secondary education in his home province. He was awarded the American Field Service (AFS) exchange scholarship and was a high school exchange student in Minnesota, USA, in 1967-1968. He returned to Bangkok, Thailand and attended Thammasat University for two years before winning a scholarship from Claremont Men's College, Claremont, California, to complete his B.A. in Political Science (cum laude) in 1972. He then went on to Harvard University, Cambridge, Massachusetts, U.S.A., where he received his M.A. and Ph.D. in 1974 and 1982 respectively, in the field of Political Science and Middle Eastern Studies.

His entire Harvard career was supported by the Winston S. Churchill Association and Rockefeller Foundation Fellowships. He also spent a year and a half studying Arabic and conducting his research at the American University in Cairo, 1975-1977, while concurrently a fellow at the Higher Institute of Islamic Research, Cairo, Egypt. He worked as a columnist for the Nation and the Bangkok Post, the two leading English daily newspapers in Bangkok, from 1975-1992.

Dr. Surin taught at the Faculty of Political Science at Thammasat University from 1978-1983 and 1984-1986. He also served as an assistant to the Deputy Dean for Academic Affairs during the same period. He also ran for a Parliamentary seat from Nakorn Sri Thammarat, his home town. He has been returned to Parliament eight times since 1986. As an MP, he was appointed Secretary to the Speaker of the House of Representatives (Chuan Leekpai), Secretary to Deputy Minister of Interior, Deputy Minister for Foreign Affairs during 1992-1995 and Minister of Foreign Affairs from 1997 to 2001. He served as Chair of the ASEAN Ministerial Meeting and the Chair of the ASEAN Regional Forum (ARF) in 1999-2000. In September 1999, while the ASEAN Chair, he led the efforts to get Southeast Asian governments to help restore law and order and that joint undertaking, with the support of the United Nations and the international community, brought about peace and security in East Timor.

He was nominated by the Royal Thai Government and endorsed by ASEAN Leaders to be ASEAN Secretary-General for year 2008-2012.

Currently, he has engaged working with Thammasat University as a Professor Emeritus at Thammasat University. He is a visiting professor, an Adjunct Professor and visiting fellow at many Graduate Institutes in Policy Study; University of Nara, University of Malaya, University of Brunai and also a chairman of the future innovative Thailand Institute. Moreover, Prof. Surin has been nominated to be a Special Envoy for Thailand Candidature for UNSC 2017-2018.

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The "Fishing for Litter Programme", an Example of a Practical Policy and Management Tool Applied on the International Level to Address the Extensive Environmental Problem of Plastic Pollution in the Marine Environment

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Paper # PN I-1-i

Abstract

Plastic pollution in the marine environment is an extensive problem on a global scale with a large number of environmental impacts, with adverse effects on e.g. the ecosystem, fisheries and tourism. KIMO is a local authorities international environmental organisation designed to give municipalities a political voice at regional, national and international level. For almost 15 years, the organisation coordinates a project called Fishing for Litter — an imaginative yet simple initiative that aims to reduce marine litter by involving one of the key stakeholders, the fishing industry. The initiative not only involves the direct removal of litter from the sea, it also raises awareness of the problem in the fishing industry. On the policy level this included extensive lobbying on the local, national, European and international level. As a result, fishing for Litter is currently operating in the UK, the Netherlands, Sweden and the Faroe Islands and has been endorsed by OSPAR as a model for their members to adopt. Thus, it evolved from a locally oriented project to an initiative that influences international maritime environmental policy and decision making processes. The past 15 years over 4500 tonnes of marine litter have been collected by fishing vessel in the countries where the project has been implemented.

***Keywords*:** fishing for litter; marine pollution; plastic soup

Impact of Aerosol Direct Effect on $PM_{2.5}$ Concentration by an Online Coupled Meteorology-Air Quality Model over East Asia

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Paper # PN II-2-i

Abstract

The impact of the aerosol direct effect on $PM_{2.5}$ concentrations was evaluated over East Asia, which are controlled by heavy local air pollution and long-range transport. The evaluation was carried out by online coupled Weather Research and Forecasting-Community Multiscale Air Quality (WRF-CMAQ) modeling system. The largest temporal mean contributions of the direct effect were 40% decrease in the surface shortwave radiation, 30% decrease in the planetary boundary layer height, and 20% increase in the ground-level $PM_{2.5}$ concentration in the continent. In the most remarkable long-range transport event in the simulation period, the aerosol direct effect increased the ground-level $PM_{2.5}$ concentration in China and decreased the concentration in Japan.

Conservation in the Anthropocene: Navigating Ecosystem Transformation

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Paper # PN II-3-i

Abstract

In what has been dubbed 'the Anthropocene' epoch, humans are having unprecedented impacts on ecosystems. Strong pressures coming from climate change and land degradation mean not just species loss but also transformation of highly-valued landscapes (socially, economically, and ecologically).Existing policy and management interventions are already failing to stem ecosystem degradation, but reform holds promise as an adaptation strategy. The discussion about what to do in such 'novel' ecosystems, however, has been contentious and debated on both scientific and philosophical grounds. While models may predict such transformation, identification of thresholds is still difficult and different models point in different directions, depending on which variables are used. Uncertainty combined with strong cultural preferences about how landscapes "should" look present a challenging task for managers and policy-makers deciding how to translate research into practice. In order to effectively respond, we need practical techniques for understanding complex social-ecological system dynamics and exploring what the future might look like under multiple scenarios. This presentation will describe a novel approach to scenario planning that can be used to test different ways of intervening in landscapes where transformation is imminent. The approach allows integration of data from different disciplines in order to understand a social-ecological system's dynamics. From here, a range of future scenarios can be developed, and the outcomes under each scenario can be examined. Critically, this approach has been developed to allow testing of different approaches to governance and management to decide how both may need to change to navigate toward more "desirable" future scenarios. The strengths and the weaknesses of this approach, both as a research methodology and a decision making tool, will be discussed, drawing on its application in Australia.

Emerging Environmental Issues for AEC Countries with Emphasis on Hazardous Chemicals

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Paper # PN II-4-i

Abstract

The ASEAN Economic Community (AEC), in effect since 2015, comprises of 10 countries located in Southeast Asia. With the total population of over 600 million and trade volume of US$1,600 billon, the AEC is expected to create more economic and industrial development including tourisms in the region. It is inevitable that these developments will result in more environmental problems such as water pollution, soil contamination and health risks. Of particular concerns are the hazardous chemicals or persistent organic pollutants (POPs) which can cause both short-term and long-term health effects. Examples to be presented are polychlorinated biphenyls (PCBs) oil pollution and pharmaceutical residues in water resources in Thailand and dioxin contamination of soil and water in Vietnam. These hazardous chemicals do not easily degrade, remain in the environment for a long period of time and can accumulate/magnify in the food chains (Fujii et al, 2007). Technologies to control these hazardous chemicals are available such as co-processing in cement kilns, advanced constructed wetlands and nanotechnology including catalytic reactions which can degrade these hazardous chemicals more than 99.99% (Jiamjitrpanich et al. 2013 and Khumsaeng et al. 2013). The success of the pollution control programs would depend on other factors such as political will, finance and public awareness.

Behavioral Aspect of Community Participation in Environmental Impact Assessment

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Paper # RT-1-i

Abstract

Generally environment has tremendous involvement with a variety of significant components positively and negatively. The creation of positive desirable or undesirable impact of environment has the greatest impact on different aspects of human, society, and the world. Environment can be simultaneously changed according to the nature. While unnatural changes can be created purposely or unpurposly mostly known as manmade environmental change. Its impacts can be immediately visible and long term effect.

In principle, the control and prevention of environmental change with its minimized impact can be managed provided that thorough studies and sufficient considerations have been manipulated prior to environmental change. Therefore dealing with environmental impact assessment on any large scale project necessary for desirable development, the crucial aspects of environment have to be intensively considered. The crucial aspects are comprised of the following ones namely, biological, chemical, physical, natural resources, health, social, and behavioral aspects. These components of environment and environmental change have direct and indirect interrelation to each other.

In term of behavioral aspect, it plays significant role in environmental impact assessment being conducive to effective degree of community participation resulting to its sufficient impact assessment. The behavioral domain of environmental impact assessment comprises the degree of individual and community learning on the proposed development project, environmental changes and its impacts on different aspects, the process of desirable management on the impact, its alternative approaches, etc.

Hence the most important consideration on planning and management of environmental impact assessment has to be given to the development of behaviors among target population and community to strengthen the environmental assessment process for the obtainment of maximized assessment outcome basing on desirable community participation.

Rehabilitation Approach of Klity Creek Contaminated with Lead, Kanchanaburi Province, Thailand

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Paper # No. I-1-i

Abstract

The contamination of lead in Klity Creek, Tong Phapoom District, Kanchanaburi Province, which might be caused by the episode of discharge of lead contaminated tailing wastes from tailing pond of the Lead Concentrate (Thailand) Ltd. To the Klity Creek in 1998. It has resulted to the contamination in water, sediment and aquatic animals as indicated by the concentration in such medium exceeding the standards. It has further affected to the water use of people for domestic consumption and drinking.

Lead Contamination in Klity Area is induced by 2 causes, First, Natural process. It is induced by weathering and transportation of lead deposited soil into the Klity Creek due to Tong Phapoom District is the major potential source of lead in Thailand. Second, Man made activity for lead mining and processing. This lead mining activity had been conducted for a long time. Lead contamination in the Klity Creek area due to the tailings draining to the Klity Creek where flow passing through the Klity village.

Background concentration was studied by Pollution Control Department by collection of soil in the upper Klity, middle Klity (lead ore processing mill), and lower Klity communities. The 95 percentile concentration were 784, 821 and 219 mg/kg. Thus, the background concentration is 821 mg/kg. Due to the concentration of lead existed in the area of lead ore processing mill and adjacent area were high to very high, with the remediation measures by excavation or capping could decrease the concentration down to background concentration. The target concentration was used as background concentration as 821 mg/kg.

The first action approach is included of secure landfill construction for disposal of lead contaminated sediment dredged from the Klity Creek and tailing waste, rehabilitation at the lead ore processing mill and adjacent area, sediment dredging at the high risk section at the creek, and construction two weirs for sediment trapping.

Environmental quality monitoring programme are prepared for surface water, ground water, edible vegetative, fish and aquatic life, ambient air near community, soil and plants.

Membrane-Aerated Biofilm Reactors for Nitrogen Removal and Mitigation of Nitrous Oxide Emission from Wastewater Streams

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Paper # No. I-2-i

Abstract

Membrane-aerated biofilm reactors (MABRs) are promising for cost-effective removal of organic carbon, nitrogen and other contaminants. Due to a gas-permeable membrane as a reactive carrier where air is supplied, a counter-diffusion biofilm geometry can be attained. This allows precise and independent control of electron donor and acceptor supplies, permitting simultaneous nitrification/denitrification, and partial nitrification/anaerobic ammonia oxidation. Success of the simultaneous oxidation and reduction in a single bioreactor vessel is driven by clear spatial distribution of bacterial guilds where ammonia-oxidizing bacteria (AOB) are located adjacent to a gas-permeable membrane. By using several laboratory-scale bioreactors, we have demonstrated that an MABR is advantageous to achieve simultaneous nitrification/denitrification with a high oxygen utilization efficiency and low emission of nitrous oxide (N_2O), known as a highly potent greenhouse gas. In this presentation, we report these advantages of MABRs and challenges towards the commercialization as a cost-effective and novel wastewater treatment system.

Keywords**:** biological nitrogen removal; gas-permeable membrane; membrane-aerated biofilm reactor; microelectrode; nitrous oxide; oxygen utilization efficiency; simultaneous nitrification; denitrification

Preparing for Extreme Droughts and Floods in Southeast Asian Countries

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Paper # No. I-3-i

Abstract

In recent years, serious damages from extreme droughts and floods occurred in many areas in Southeast Asian countries. For mitigating the impacts from the drought and flood events, well-prepared water resources management is highly required, for which the quantification of rainfall and resulting runoff in the whole rainy season as well as individual rainfall events is one of the key fundamental information. Furthermore, it will be more demanding due to climate change and socio-economic development of the region in coming decades. Some example studies conducted by our group will be presented to share the result and knowledge in quantifying rainfalls and floods in various temporal and spatial scales.

In the first topic, I will introduce our study to estimate basin-scale seasonal rainfall based on the existing climate indices that represent the variations of Asian summer monsoon and El Niño–Southern Oscillation. Through the study, we found multiple climate indices that are effective and dominant in quantifying the amount of rainfall. Finally, we found a consistent method applicable for estimating areal-averaged seasonal rainfall over five selected basin-scale domains located in a wide spatial range in Indochina Peninsula (from Mekong Delta in the south to the Ping River Basin in the north).

Based on the quantified rainfall, we attempted to estimate the runoff into streams and reservoirs. Since the temporal resolution of estimated rainfall is coarse (up to a whole rainy season), we generated a large number of randomly distributed daily rainfall patterns and put them into a conceptual hydrological model to perform rainfall-runoff simulations. We found that the approach gives acceptable estimates of inflow to a downstream reservoir, while the uncertainty range is large in some years when the total rainfall is not well quantified. We will discuss the possibility and limitations to obtain more reliable runoff estimates.

In the second topic, I will introduce the subject related to extreme floods, mainly by explaining our research outcomes from urban and basin-wide inundation simulations for selected cities. Elaborated explanation will be given for the study of the capital city of Cambodia. This will be an example case to highlight the influence of climate change and rapid urbanization in cities in Southeast Asian countries on the increased vulnerability against water-related disasters. Also, we can share the information how the impact of climate change is scaled down to a specific city scale.

At the end of my presentation, I will try to discuss challenges and perspectives for well-prepared water resources management in cities and basins located in Southeast Asian countries.

Environmental Performance and Optimization Approaches of Aluminum and Beech Wood Window Frames

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Paper # No. I-1-O

Abstract

Environmental Performance and optimization approaches are methods for performance assessment and efficiency for the natural viewpoints and potential effects related with a product, by aggregating a stock of important material data sources and natural releases such as Life Cycle Assessment (LCA) technique and DesignBuilder Software. In this research, the LCA of the aluminum and the beech wood, as two usually utilized materials components in Egypt for the window outlines, is conducted with applied optimization model. Window outlines manufactured of the two unique materials have been surveyed considering their creation, energy utilization and ecological effects. The impact of aluminum and beech wood materials on environmental change for the windows, are 81.7 mPt and -52.5 mPt (milliPoint) respectively for a reference window (1.2m×1.2m). Non-renewable energy source utilization, potential commitments to the green architecture impact and amounts of waste have a tendency to be minor for the wood items contrasted with aluminum items. Whereas their impact in use for the comfort are vise versa.

***Keywords*:** green building; LCA; optimization; SimaPro; DesignBuilder; aluminum window frame; beach wood window frame

Coconut Shell Activated Carbon with Beta-Silicon Carbide Reinforced Polymer Composites: An Alternative Dielectric Material for Microwave Absorber

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Paper # No. I-2-O

Abstract

The effect of adding natural based activated carbon, namely coconut shell activated carbon (CSAC) on the structural and dielectric properties of beta-silicon carbide (β-SiC) reinforced polymer composites were investigated. This work aims to assess the potential of using CSAC as conductive filler in the β-SiC based dielectric material used for microwave absorber. Material characterization of the CSAC in term of elemental composition, particle morphology and structural analysis have been performed by using carbon, hydrogen, nitrogen, sulfur (CHNS) elemental analyzer, scanning electron microscope (SEM) and X-ray Diffractometer (XRD). Room temperature open-ended coaxial line method was performed to determine the dielectric properties over broad band frequency of 200 MHz - 20 GHz by using Agilent 85070E Dielectric Probe Kit and Agilent E8362B PNA series network analyzer. The microwave conductivity of the composites was evaluated based on the measured dielectric properties. Experimental result shows that CSAC is highly carbonaceous material with 83.94% of carbon composition and presence of macroporous structure with particle porosity ranging from 446.6nm to 2.5μm was detected. The XRD pattern of coconut shell activated carbon revealed that presence of broad diffraction peaks are detected at 2Θ= 23.985° and 44.015°, which corresponded to amorphous structure. With the addition of CSAC, it was found that the dielectric properties of the β-SiC composites show improved dielectric properties (ε' and ε") starting from 6.18 GHz to 20 GHz. Both real and imaginary parts of permittivity of the composites decrease with increasing frequency, which present the typical dielectric relaxation characteristic. The presence of CSAC increases the composite electrical conductivity at microwave frequency. This indicates that the natural activated carbon, CSAC could thus be used as conductive filler not only for their dielectric losses performance, but also for their cost effective production.

***Keywords*:** coconut shell activated carbon; beta silicon carbide; dielectric properties

Evaluation of Greenhouse Gas Emissions from Municipal Solid Waste (MSW) Management: Case Study in Lampang, Thailand

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Paper # No. I-3-O

Abstract

The issue of municipal solid waste (MSW) disposal and greenhouse gas emissions are concerned on global warming. The greenhouse gas reduction of waste generation system is the one of management strategies from the National Economic and Social Development plans in Thailand. This project evaluated the greenhouse gas emissions from municipal solid waste system covering transportation and disposal in Lampang, Thailand. At the start of the data collection, greenhouse gas emissions were estimated based on the travel distance of the vehicles for transportation process by the vehicle emission model. As for disposal process was estimated from the model developed by Institute for Global Environmental Strategies (IGES). The results showed that the sanitary landfill released more GHG emissions than transportation process. The GHG emissions from sanitary landfill are highly contributed by the landfill methane (CH_4) emissions (20,346 tonnes CO_2eq/year). In addition, carbon dioxide (CO_2) was mostly emitted (226 tonnes/ year) from transportation process. This evaluation found that GHG emissions calculation based on travel distance was lower than those based on fuel consumption (44%). Furthermore, changing diesel fuel to compressed natural gas of vehicles will reduce GHG emissions by approximately 7%.

***Keywords*:** greenhouse gas; solid waste; municipal; emission; Lampang

Estimation of Air Temperature from Thermal Images by Low Flying and Shade Effect of Tree Crown for Mitigating Urban Thermal Circumstances

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Paper # No. I-4-O

Abstract

Tree effects for mitigating thermal circumstances in a town and determination factors of air temperature have been examined. We used aerial thermal images of ground surface temperature taken by flights of a hang glider and mobile observation of air temperature by a bicycle to evaluate the effective range that decides air temperatures. The average of grand surface temperature of 1 ha area, approximate radius is 55 m, has the highest correlation to air temperatures than the average of narrower area. The fluctuation of spatial differences of ground surface temperature was highest in a town area and lowest in a forest area. Tree shade effects on air temperature have been observed at an open field and a small forest in a town. The air temperature at a small forest showed comparatively lower at the time of highest temperature while showed comparatively higher at the lowest temperature. Accumulation of these results is important to create resilient cities for environmental disasters such as heat-related illnesses.

***Keywords*:** heat stroke; global warming; urbanization; heat island; mobile observation

Impact of Acid Deposition on Plankton Population Variability in the Bangphra Reservoir Water Supply, Chonburi Province, Thailand

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Paper # No. I-5-O

Abstract

Eutrophication caused by cyanobacterial blooms in urban water supplies can affect freshwater ecosystems and become a human health concern. The objectives of this study were to understand how highly acidic rainwater may influence the freshwater in the Bangphra Reservoir and how it may seriously impact water quality and plankton diversity. Rainwater samples were collected daily during the wet (July-October 2010) and dry (November 2010-June 2011) seasons. The results indicate that, the annual precipitation for each season was 1,250 mm and 1,623 mm, and the annual volume-weighted mean pH of rainwater was 4.73 and 4.59, respectively. For anion accumulation, chloride and sulfate were the most abundant, compared to nitrate. Cation accumulation showed that sodium was the most abundant, followed by ammonium, potassium, calcium and magnesium. The freshwater in the Bangphra Reservoir was collected daily during the same time period. The freshwater pH and biological oxygen demand in the wet season were 8.05 and 0.72 mg/l; for dry season samples, averages were 6.73 and 0.48 mg/l. The total phytoplankton abundance in the wet season (216,468 cells/l) was found to be more than 7 times higher than in the dry season (27,826 cells/l). However, changes in the phytoplankton diversity index between wet and dry seasons did not show a significant difference (1.774 and 1.679). The most abundant genus in both wet and dry seasons was *Microcyctis* sp., while *Lyngbya* sp. was found only in the wet season and *Phacus* sp. was found only in the dry season. This corresponds both to the lower pH of freshwater in the dry season. Results presented here showed the abundance of zooplankton in the wet season (4,147 cells/l) was nearly twice as high as during the dry season (2,112 cells/l), while the changes in the zooplankton diversity index from wet to dry seasons did not show significant difference (1.496 and 1.577). The increase in phytoplankton during the wet season, especially of cyanobacteria, may influence the abundance of zooplankton and subsequently the water quality of the Reservoir.

***Keywords*:** acid deposition; water quality; Bangphra reservoir; phytoplankton; zooplankton; *Microcyctis* sp., *Lyngbya* sp., *Phacus* sp.

Estimation of Leachate Generated from Zimbabwe's Municipal Solid Wastes (MSW) Landfills Using a Simple Stochastic Water Balance Model

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Paper # No. I-6-O

Abstract

With twin concerns of air emissions and routine leaching of hazardous substances from unsanitary landfills in Zimbabwe, immediate corrective action is needed to avert further environmental degradation. Poor waste management practices largely due to the financial incapacitation of local authorities have taken a toll on the environment. The open dumping of municipal solid wastes (MSW) in most landfills is reportedly leading to groundwater contamination and toxic air emissions in certain areas. The lack of comprehensive MSW generation and collection data has made the quantification of MSW and resultant leachate difficult. This article attempts to estimate the leachate volumes released since year 1980 to date using a simple stochastic water balance method supported by 10 000 Monte Carlo iterations. Such information is essential when assessing the impact of the leachate on groundwater or a facility to which the leachate can be conveyed. The calculated 90% confidence interval indicates that 13 -16 million metric tons of MSW have been landfilled with about 41 – 128 million m^3 of leachate released since 1980.

Keywords**:** water balance; Monte Carlo; leachate; Zimbabwe; MSW; unsanitary landfill; estimation

Mass Balance of Hydrogen Cyanide and Hydrogen Sulfide Gases Removal by Dual Fixed-Film Bioscrubber

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Paper # No. I-7-O

Abstract

This study presents a practical mass balance calculations of hydrogen cyanide and hydrogen sulfide gases removal by dual fixed-film bioscrubber system. A mixed culture of *Agrobacterium tumefaciens* SUTS 1 and *Pseudomonas monteilii* SUTS 2 for hydrogen cyanide removal while a mixed culture of *Acinetobacter* sp. MU1_03 and *Alcaligenes faecalis* MU2_03 for hydrogen sulfide removal. The long-term system results showed high removal efficiency of hydrogen cyanide and hydrogen sulfide that was 99.06% and 98.66%, respectively. It revealed that mass-in and mass-out was 93.60 mg/m^3•h and 7.30 mg/m^3•h for hydrogen cyanide removal whereas the mass-in and mass-out for hydrogen sulfide removal was 177.40 mg/m^3•h and 14.80 mg/m^3•h, respectively. These found that the mass-in higher than the mass-out, it might be due to these bacteria could utilize the compounds such as cyanide, sulfide, or the by-product compounds for their growth.

***Keywords*:** dual fixed-film bioscrubber; biodegradation; hydrogen cyanide; hydrogen sulfide; mass balance

Batch Reactor Design for Algal Biosorption of Mercury-Contaminated Acidic Water

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Paper # No. I-8-O

Abstract

The risk of mercury poisoning cannot be over-emphasized. Toxic mercury exposure can lead to fatal damage to the nervous, immune, respiratory, renal and digestive systems. However, despite stern warnings from environmental authorities, the rudimentary and unscrupulous operations of miners in Zimbabwe have resulted in its unprecedented release into potable water sources. Artisanal gold mining activities employing the mercury amalgamation process have resulted in a significant drop in the quality of water from Ngwabalozi River in Zimbabwe. Mercury levels as high as 0.31 mg l^{-1} have been reported in its waters with a pH as low as 3. The aim of this study is to develop a low-cost batch reactor for the removal of Hg from Hg contaminated acidic water to meet the WHO standard of 0.006 mg l^{-1} using algae. Algae (*Cladophora* sp.), a widely abundant natural biosorbent, is relatively cheaper than industrial synthetic adsorbents hence its choice in this study. Experimental results reveal a high affinity for total mercury removal in acidic water. More than 99% of the mercury in solution was removed within the first five minutes of contact and equilibrium was attained after ten minutes. High adsorption capacities (up to 805 mg kg^{-1} at pH 3) were obtained at the optimum Hg concentration of 1.0 mg l^{-1}. The experimental data fitted very well with the pseudo-second order kinetics model. The equilibrium isotherm capacity equations were used in the design of a 1000 l-batch reactor. Using the experimental equilibrium contact time of 10 mins, the batch reactor design model showed that the adsorbent mass required per batch is in the range 3.9 kg to 15.7 kg for minimum and maximum initial mercury concentrations of 0.25 mg l^{-1} and 1.0 mg l^{-1}, respectively.

Keywords**:** biosorption; algae; mercury; batch reactor; acidic water

Health Risk Assessment of Nitrogen Dioxide and Sulfur Dioxide Exposure from a Developing Coal Power Plant in Thailand

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Paper # No. I-9-O

Abstract

Krabi coal-fired power plant is the new power plant development project of the Electricity Generating Authority of Thailand (EGAT). This 800 megawatts power plant is in developing process. The pollutants from coal-fired burning emissions were estimated and included in an environmental impact assessment report. This study aims to apply air quality modeling to predict nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) concentration which could have health impact to local people. The health risk assessment was studied following USEPA regulatory method. The hazard maps were created by ARC-GIS program. The results indicated the influence of the northeast and southwest monsoons and season variation to the pollutants dispersion. The daily average and annual average concentrations of NO_2 and SO_2 were lower than the NAAQS standard. The hazard quotients (HQ) of SO_2 and NO_2 both short-term and long-term exposure were less than 1. However, there were some potential risk areas indicating in GIS based map, the distribution of pollutions and high Hazard Index (HI) values were near the power plant site. Although this coal power plant is not constructed yet but the environment health risk assessment has been evaluated to be the information for the future coal plant development.

***Keywords*:** health risk assessment; AERMOD; hazard map; coal fired power plant; Thailand; GIS

Nutrient Removal Performance on Domestic Wastewater Treatment Plants (Full Scale System) between Tropical Humid and Cold Climates

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Paper # No. I-10-O

Abstract

Two full scale systems of oxidation ditch for domestic wastewater treatment plant (WWTP) were used as study sites: Phuket Province, southern Thailand (representative of tropical humid climate) and Plum Creek, Castle Rock, Colorado, United States of America (USA) (representative of cold climate). The treatment systems at both sites were designed for biological nutrient removal (BNR), extended activated sludge. Nitrogen is removed by nitrification-denitrification processes. The SRT for both treatment plants is ≥ 10 days as recommended by theory for complete nitrification in activated sludge wastewater treatment plant. Influents and effluents from these sites were compared and are discussed regarding flow rate, biochemical oxygen demand (BOD), organic nitrogen, ammonium, nitrate, total nitrogen, and phosphorus concentrations. High nutrient removal performances were found in both sites because there was sufficient carbon for denitrifying and phosphate accumulating organisms (PAOs). Furthermore, low dissolved oxygen concentration, long SRT, and high temperature could be key factors to promote the activity of some groups of bacteria to consume organic matter and nutrients in wastewater in the warm climate. For this reason, the plant design and operating procedures for wastewater treatment in a cold climate might not be always applied to a warm climate.

***Keywords*:** nutrient removal performance; Phuket wastewater treatment; Phuket; plum creek; castle rock; Colorado; USA

Adsorption of Cadmium (II) Ions from Synthetic Wastewater onto Fly Ash

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Paper # No. I-11-O

Abstract

Fly ash, a solid waste material obtained from MaeMoh thermal power plant in Thailand, is used to investigate as an adsorbent for the removal of cadmium (II) ions from synthetic solution. As much as 99.97% removal of cadmium is possible in about 24 h. The adsorption studies were carried out in a batch experiment using Atomic Absorption Spectroscopy (AAS) Technique, covering different process parameter such as the effect of contact time, amount of adsorbent and precipitation under constant stirring condition and an initial Cd (II) ions concentration. Amount of 20 g of adsorbent was sufficient for the optimum removal of Cd (II) ions. The material exhibits good adsorption capacity and the equilibrium adsorption data follow the Freundlich model better than the Langmuir model. Therefore, the removal mechanism of cadmium ions in the present study is followed adsorption.

***Keywords*:** fly ash; adsorption; heavy metal; cadmium

Predicting Energy Consumption Using Artificial Neural Network (ANN): a Case Study in a Cold Store in the North Island of New Zealand

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Paper # No. I-13-O

Abstract

This study was developed to predict energy usage, based on the amount of fruit stored and environmental factors, using an artificial neural network model (ANN) in a New Zealand cold store. In this study, after investigating several transfer functions and structures, an ANN model was developed to reduce margins of error in energy auditing projects in a cold store. The final ANN model developed was based on weekly numbers avocado and kiwifruit bins and outside temperatures. The comparison between different models demonstrated the amount of stored fruits have more sensitivity than the outside temperatures in cold stores. Comparing actual and predicted energy usage in the studied cold store showed that the ANN model could be fitted to energy usage data and accounted for around 95% of the variance.

***Keywords*:** energy saving; energy auditing; artificial neural networks; cold store

Applicability of Carbon Nanotubes for Removing Toxic Organic Compounds from Effluent Water

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Paper # No. I^{+}-1-i

Abstract

A number of synthesized organic compounds such as pharmaceuticals and pesticides are intended to be non-biodegradable and are often water soluble characteristics. Thus, they can be frequently found in wastewater and ended up in natural waters, causing a long-term potential threat and serious consequences in water environments. Recently, carbon nanotubes (CNTs) has being intensively investigated as a promising adsorbent of toxic organic compounds for developing novel water treatment systems. In this presentation, we provide a brief overview of the adsorption property of CNTs and its potential applications of CNTs to mitigate environmental degradation caused by toxic organic compounds. Compared to conventional adsorbents used in water treatment (e.g., activated carbon), CNTs can be generally characterized by higher capacity and faster rate of adsorption for organic compounds while they also indicate a certain selectivity in adsorption process depending on physicochemical condition.

Effect of Acid-Alkaline and Thermal Pretreatment on Cassava Pulp Feed Batch Reactors in Optimization of Bio-Methane Yield

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Paper # No. I+-1-O

Abstract

Cassava starch mills in Nakhon Ratchasima province operate biogas plant to harness renewable energy from surplus cassava pulp by Anaerobic Digestion (AD) technologies but the industry encounters fluctuated biogas yields and digestion failure due to the lack of effective digester configuration and understanding on specific properties of cassava pulp substrate. This study used acid-alkaline and thermal pretreatment to modify the cassava pulp substrate to enhance biogas yield. Concentrated 36N sulfuric acid (H_2SO_4) and 20 N sodium hydroxide (NaOH) had been chosen as acid-alkaline pretreatment to adjust pH of hydrolyzed substrates, and 200˚C for 45 min was given as thermal pretreatment. Extreme pH adjusted substrates such as T1, T2, T12 and T13 required both acid and alkaline in high volume, and inhibition occurred from both acid and alkaline resulting retarded fermentation executed by hydrolytic bacteria upon digestion started, fewer volatile fatty acid to total alkalinity ration (VFA:TA), more reducing sugars depletion and lesser bio-methane yield. The results showed Soluble Chemical Oxygen Demand (SCOD) obtained from decomposition of lignocellulosic structure of fresh cassava pulp by combined thermal-chemical pretreatment, was found highest in T2 which was pretreated to pH 2 having more than 100 g/l. Though SCOD could be enhanced by acid-alkaline pretreatment, it led to inhibition driven by radicals of acid and alkaline. Three different mixing ratios, i.e. 3%, 5%, and 10% (w/v) were compared for batch process, and found 5% Total Solid (TS) was most suitable after subjected to acid-alkaline pretreatment and produced biogas yield at 4125.2 ml/kg TS in batch digestion for 21 days. The pretreated results were compared against without pretreated samples, and found biogas could be produced up to 6 folds than without pretreated samples.

***Keywords*:** cassava pulp; acid-alkaline; thermal pretreatments; anaerobic digestion; SCOD

Impact of Land-Use Activities on Surface Water Quality in the Pazuntaung Creek, Myanmar

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Paper # No. I^{+}-3-O

Abstract

The aim of the present study is to assess the impact of land-use activities on physico-chemical parameters and some heavy metals of water in the Pazuntaung Creek which is a major drainage channel and outflows to the Yangon and Bago Rivers. Water samples were collected from fifteen sampling stations by representing three main land-use activities: forest, industries and household. The results showed the physico-chemical parameters of water as follows: pH (6.3-6.9), TSS (5.25-446.00 mg/l), DO (2.84-6.53 mg/l), BOD (3.00-24.07 mg/l), nitrate (6-50 mg/l), phosphorous (0.05-4.50 mg/l), temperature (27-31 ºC) and salinity (0.0-0.1 ppt). The ranges of heavy metal concentrations were Cd, from 0.122±0.271 mg/l to 0.148±0.293 mg/l , Cr, from 0.176±0.144 mg/l to 0.191±0.184 mg/l, Cu, from 0.001±0.004 mg/l to 0.006±0.004 mg/l, Zn, from 0.289±0.059 mg/l to 0.317±0.059 mg/l. TSS (273.40±80.35 mg/l), BOD (17.53±2.16 mg/l), nitrate (34.00±12.25 mg/l) and salinity (0.1±0.0ppt) values are higher in the industries-dominated sites ($p<0.05$) than those in the forest-dominated sites. Moreover, the concentration of TSS (357.80±74.29 mg/l)**,** DO (4.42±0.58 mg/l), salinity (0.1±0.0ppt), nitrate (36.60±14.63 mg/l) values are higher in the household-dominated sites ($p<0.05$) than those in the forest-dominated sites. In contrast, the forest-dominated sites had high level of DO and low levels of nitrate compared to those from industries and household-dominated sites. All in all, the study indicates that the industries- and household-dominated land-uses were the main factors affecting to the surface water quality and it could be recommended that the two areas need an urgent waste water management to prevent the discharge of the pollutant loads into the creek.

Keywords**:** Pazuntaung creek; land-use; heavy metal; surface water quality

Reproductive Toxicity and Acetylcholinesterase Inhibition of Profenofos on Japanese Medaka, *Oryzias latipes*

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Paper # No. I^{+}-4-O

Abstract

Effects of low doses of profenofos on the reproduction and acetylcholinesterase enzyme activity of Japanese Medaka, *Oryzias latipes* (Temmick & Schelgel, 1846) were examined. Spawning fish were exposed to 0.005, 0.03 and 0.2 mg/L profenofos for 7 days. Total egg production and fertilization rate were recorded. Embryos collected were incubated to monitor hatching days and survival rate. Fish were decapitated at the end of the exposure and brains were removed for acetylcholinesterase enzyme assay. Egg production, fertilization, embryo hatching days and embryo survival were found to be affected by profenofos. Hatching days and survival rate of the embryos were 8.81, 9.44, 9.52 and 10.86 days, and 95.2, 85.8, 73.4, and 42.2% for control, low, middle and high exposure group, respectively. Developmental toxicity in relation to behavior and interactions with the targeted enzyme were also assessed. Acetylcholinesterase activity in fish brain was competitively inhibited in a dose-dependent manner.

***Keywords*:** Japanese medaka; pesticide; profenofos; embryo survival; fecundity; acetylcholinesterase; enzyme kinetics

The Measurement of Nitrous Oxide Emission from Maize Cultivation

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Paper # No. I^{+}-5-O

Abstract

Field experiments were conducted during the 2014 and 2015 seasons to investigate the effect of inorganic nitrogen (N) fertilizer application on silt loam soils regarding nitrous oxide (N_2O) emissions, soil properties, biomass and maize yield. Daily N_2O emissions from three treatments: control with no fertilizer input (T1), 97 (T2) and 155 (T3) kg N ha^{-1} were studied using the static chamber method for maize (*Zea mays* L. var. Suwan 4452) cropping in a tropical savanna climate in Nakhon Ratchasima Province, Thailand during wet and dry seasons. Results indicated that the average N_2O fluxes in the T1, T2 and T3 treatments during the wet season were 0.33, 0.65 and 0.88 mg N_2O m^{-2} day^{-1}, and in the dry season 0.83, 1.11 and 1.29 mg N_2O m^{-2} day^{-1}, respectively. The highest N_2O fluxes were observed in the T3 treatment, corresponding to 18–32% of N_2O emissions. Values increased sharply after 5–7 days of N fertilization. The rates for N_2O emissions in the dry season were significantly higher than in the wet season (P<0.05) due to nitrification and denitrification processes and the different in maize cultivated condition such as, soil inorganic N, soil bulk density, and air temperature. With no different crop yields in the wet season, the T2 treatment had lower N_2O emissions than the T3 treatment and this fertilizer treatment could be applied for the sustainable maize farming.

Keywords**:** nitrous oxide flux; static chamber; maize cultivation

The Effect of Steam and Glycerol Pretreatment on Chemical Contents of Oil Palm Empty Fruit Bunch (EFB)

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Paper # No. I^{+}-6-O

Abstract

This research aimed to evaluate the effect of the type of solvent, pH, substrate loading, and reaction time on the chemical components of palm Empty Fruit Bunches (EFB). Steam pretreatment was set up at 121°C temperature and 1.18bar pressure, using an autoclave with substrate loading of 5, 10, 15 and 20% w/v at reaction times of 15 and 60 min. Distilled water, waste glycerol, alkaline glycerol and acidic glycerol were used as solvents during steam pretreatment. The results showed that with distilled water, better pretreatment was achieved at 5% and 10% loading for 60 min. During the pretreatment with waste glycerol at 5% loading an increase on the reaction time from 15 to 60 min reaction resulted in a remarkable increase in reducing sugar in the liquid phase. Overall, the best condition of steam pretreatment was observed using alkaline glycerol at 5% w/v and 15 min reaction time, resulting in a cellulose increase to 66.20% and a lignin decrease to 9.17%. However, pretreatment with glycerol for 15 min was better than those for 60 min using either glycerol or distilled water. The results suggest that waste glycerol during steam pretreatment of EFB can be utilized effectively at short reaction times and at an increased pH to achieve a high output of cellulose and hemicellulose for sugar conversion in the bioethanol fermentation process.

***Keywords*:** palm empty fruit bunch; steam pretreatment; waste glycerol; alkaline pretreatment

Emission Factors of Particulate Matter PM_{10} and $PM_{2.5}$ from Open Burning of Corn Stover in Thailand

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Paper # No. I+-7-O

Abstract

PM_{10} and $PM_{2.5}$ from burning of corn stover residues were measured from a corn farm, control area. Then the related emission factors produced by open burning were calculated using Gaussian plume dispersion equation. Fine particulate matters were collected by low volume air pump and MiniVol air sampling. Automatic weather station was used to measure meteorological data in burning area. The concentrations of PM_{10} and $PM_{2.5}$ in the corn farm before burning are 162 µg/m^3 and 97 µg/m^3 and the concentration during burning corn stubbles are 513 µg/ m^3 and 347 µg/ m^3, respectively. Emission rate of burning corn stover was calculated the fundamental air dispersion equation. Then emission factor of particulate matter (EFPMs) were calculated from total mass of burning crop and PM emission. The emission factor of PM_{10} from burning of the corn stover was 5.30±1.08 g/kg and the emission factor of $PM_{2.5}$ was 3.69±0.765 g/kg of corn stover.

***Keywords*:** PM_{10}; $PM_{2.5}$; biomass burning; emission factor

Synthesis of Calcium Oxide from River Snail Shell to a Catalyst in the Production of Biodiesel

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Paper # No. I^{+}-8-O

Abstract

This research aim to study synthesis of calcium oxide from river snail shell by calcination at 700, 800 and 900 ºC for 4 h and used as catalysts in the biodiesel production. Calcium oxide fraction in calcined river snail shell was analyzed by X-ray fluorescence (XRF), X-ray diffraction (XRD) and scanning electron microscopy (SEM). The XRF result showed the amount of calcium oxide that were 59.499%, 70.113% and 73.881%, when the calcination temperature were 700, 800 and 900 ºC, respectively. It corresponded with the XRD pattern of 800 and 900 ºC displayed the phase of calcium oxide. The SEM results exhibited that the particle was agglomerate, while the calcination temperature was increasing, the surface area of the river snail shell was porous, rough and fragile. The calcium oxide from each calcination temperature was utilized as a catalyst in the production of biodiesel. The biodiesel production from waste cooking oil and methanol in molar ratio of 6:1, reaction temperature 60-65 ºC for 3 h with 1-3 wt% of catalysts were studied. From transesterification reaction using calcined river snail shell as catalyst in 3 range of temperature. They were found that the calcination temperature at 800 ºC, the catalyst amount 1% have maximum biodiesel yield. It was 95.91%. The properties of biodiesel, flash point, heat of combustion, acid value and methyl ester content were analyzed. The results found biodiesel from this research was qualified according to the standards of department of energy business. Therefore river snail shell was the natural waste material as source of calcium oxide. As a catalyst to produce biodiesel commercially in the future.

***Keywords*:** calcination; calcium oxide; biodiesel; calcined river snail shell

Development of Novel Carbonaceous Materials for Removal of Dyes in Water

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Paper # No. I-1-P

Abstract

For sustainable development, vegetables biomass has to be recycled and reused. The carbonaceous materials can be produced from biomass, for example coffee grounds, by microwave treatment. They have a porous structure, and they may be applied for adsorbates for removal of dyes, heavy metals, organic compounds, or hazardous materials from wastewater. As there are many hydrophilic and hydrophobic groups on the surface onto carbonaceous materials. In this study, the adsorption of dyes onto the carbonaceous materials was estimated, and the adsorption ability depended upon the surface polar groups onto them. The microwave treatment would be useful for the carbonization of organic wastes.

***Keywords*:** dyes; coffee grounds; carbonization; adsorption; microwave treatment; wastewater

Removal of ZnO Nanoparticle by Duckweed (*Lemna minor*) and Water Lettuce (*Pistia stratiotes*)

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Paper # No. I-2-P

Abstract

The efficiency of duckweed (*Lemna minor*) and water lettuce (*Pistia stratiotes*) to remove ZnO nanoparticle (ZnO NPs) in water were investigated under laboratory conditions. At initial ZnO NPs concentrations of 0.0, 0.01, 0.05, 0.1, 0.5 and 1.0 mg/L, the relative growth rates (RGR_{DW}) of *L. minor* were significantly greater than *P. stratiotes.* The maximum removal of ZnO NPs by *P. stratiotes*, at the initial concentration of ZnO NPs of 0.01, 0.05, 0.1, 0.5 and 1.0 mg/L, were 79% 75% 72% 68% and 62%, respectively. For *L. minor*, the highest removal of ZnO NPs, at the concentration of ZnO NPs of 0.01, 0.05, 0.1, 0.5 and 1.0 mg/L, were 74% 70% 65% 62% and 58%, respectively. Therefore, *P. stratiotes* was more efficient than *L. minor* for the removal of ZnO NPs from the water.

Keywords**:** ZnO nanoparticle; duckweed; water lettuce

Assessment of Heavy Metal Contamination in Water Channels and Sediments of Western Chonburi Province

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Paper # No. I-4-P

Abstract

The worldwide mangrove forests have been threatened by urban development along the canal and drainage area. The mangrove areas are intercept land-derived pollutants, nutrients, and other suspended matter before releasing to the seawater. The western coastline of Chonburi province is suspected for the pollutants contamination due to its surrounded environment such as industries in the upstream, local settlements along the mangrove coastline, restaurants, and aquacultures. Aims of this study were to: 1)investigate the accumulation of selected heavy metals – cadmium (Cd), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), and zinc (Zn) – in the waters and mangrove sediments, 2) analyze the distribution of heavy metals at multiple depths, and 3) assess the pollution intensity of sediment contamination. Three sampling stations included Meuang Mai Temple, Soi Nartmontasevee, and Tesaban 3 Bridge. Each station comprised geographically related water and sediment samples. The chemical properties were analyzed according to the standard methods. The amount of heavy metals in water and sediment were measured by an atomic absorption spectrophotometer (AAS). One-way ANOVA was used for statistical differences of heavy metals variances in sediment, water during hide tide, and low tide. Enrichment factor and geo-accumulation index were used to evaluate the intensity of pollution levels. Results showed that the average amount of heavy metals were as follows: Fe > Mn > Zn > Cu > Pb > Cu. The high concentrations were likely to be found in water during low tide when compared to high tide and sediments, and high in water when compared to sediments. Along the profile depth, there was no distinct trend of increasing or decreasing pattern in heavy metals concentrations. All heavy metals in water and sediments met the requirements of the quality standards. Although Zn was considered moderately enriched in the sediment, geo-accumulation index indicated that Cu, Pb, Mn and Zn fell into the unpolluted level.

Keywords: accumulation; sediment; heavy metal; mangrove; water channel

Utilization of Dredged Sediments from Watsongpeenong Canal and Corn Cob to Produce Facing Bricks

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Paper # No. I-5-P

Abstract

The laboratory-scale study was conducted to assess the feasibility of using dredged sediments with corn cob to produce facing bricks. This study was investigated the facing bricks produced from three different proportions of dredged sediments mixed with corn cob ranging from 0, 1.5, and 2.5% by weight. The characteristics of the dredged sediments, corn cob, and fired facing bricks were analyzed using X-ray fluorescence (XRF) and X-ray diffraction (XRD), respectively. The physical-mechanical properties of fired bricks were compliant with the criteria for facing bricks (Thai Industrial Standards 168-2546). The results showed that major chemical compositions of dredged sediments and corn cob were silica (SiO_2) with the value of 43.50% and 3.95%, respectively. Heavy metal contents including Cr, Cu, Zn, Cd, Pb, and Mn were lower than the soil quality standard. The compressive strength of fired facing bricks with 1.5% and 2.5% of corn cob were 27.38 MPa and 24.58 MPa respectively, which were compliant with Thai standard for the facing bricks production. Results of this study indicated that dredged sediments and corn cob are suitable as primary raw materials in the production of facing bricks and could be considered to represent an environmental friendly product.

***Keywords*:** dredged sediments; corn cob; facing bricks

Immobilization of Lead in Contaminated Sediment by Olivine

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Paper # No. I-8-P

Abstract

Lead is a heavy metal often found contaminating in sediment. Immobilization of lead in sediment is an approach to minimize the release of the element to water. In this study, we investigated the effect of olivine on the elution of lead from contaminated sediment collected from the polluted area of Kliti Creek, Thong Phaphum District, Kanchanaburi Province. The results revealed that addition of olivine could reduce the elution of lead to water up to 86% and the most suitable amount of olivine for lead immobilization was determined as 3% w/w. Moreover, it was shown that addition of olivine could reduce the exchangeable fraction and increase the residue portion of lead in the sediment. These results confirm the environmental application of olivine for lead immobilization which may reduce the ecological and human health effects of the element in water.

***Keywords*:** heavy metals; lead; stabilization; magnesium iron silicate; olivine

Life Cycle Assessment of Facing Bricks: the Case of Utilization of Dredged Sediments from Watsongpeenong Canal with Paper Mill Residue, Corn Cob and Waste Glasses to Produce Facing Bricks

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Paper # No. I-9-P

Abstract

Brick is one of the main materials building construction. The present study was conducted to evaluate the environmental impacts of facing brick made from Watsongpeenong canal dredged sediments with corn cob, paper mill residue, and waste glasses in seven treatments including (1) dredged sediment 20 kg; (2) dredged sediment 19.7 kg with corn cob 0.3 kg; (3) dredged sediment 19.5 kg with corn cob 0.5 kg; (4) dredged sediment 19.0 kg with paper mill residue 1.0 kg; (5) dredged sediment 18.6 kg with paper mill residue 1.4 kg; (6) dredged sediment 15.0 kg with waste glass powder 10.0 kg; and (7) dredged sediment 15.0 kg with waste glass powder 10.0 kg by using the life cycle assessment (LCA) methodology quantified by Sima Pro 7.1 program from National Metal and Materials Technology Centre. Five impact categories are considered: global warming, ozone layer depletion, human toxicity, acidification, and eutrophication. The results showed the high values of environmental impacts of brick production were global warming, human toxicity, acidification, eutrophication, and ozone layer depletion, consecutively. Most of the emissions to the environment were attributed to the energy used directly from combustion fuel and indirectly used from electricity usage in laboratory.

***Keywords*:** dredged sediments; paper mill residues; corn cob; waste glasses; facing bricks; life cycle assessment

Physical and Thermal Properties of Fuel Briquette from Cassava Rhizome and Rice Husk

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Paper # No. I-10-P

Abstract

The aim of this research was to develop briquettes from cassava rhizome to obtain higher calorific value by adding rice husk with pyrolysis process. To produce briquette, cassava rhizome and rice husk were mixed into 4 ratios including 20:80, 40:60, 60:40 and 80:20 using briquette machine (hot compressive) at temperature 250 ºC and pyrolysis at 500 ºC. The results showed that charcoal made from 20% of rice husk and 80% of cassava rhizome was selected as the treatment with the most efficient characterization as renewable energy resource because it had a calorific value (4,842 cal/g) to the TCPS (5,000cal/g). As the result, cassava rhizome and rice husk are feasible for charcoal and briquette production required by TCPS.

Keywords**:** cassava rhizome; rice husk; fuel briquette

An Investigation of Urban Cool Island in Bangkok and Its Possible Causes

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Paper # No. I-11-P

Abstract

This study examines a number of aspects of urban heat island (UHI) in Bangkok, with a focus on urban cool island phenomenon. Observed 3-hourly temperature data from two surface weather stations (urban and rural) were used, covering the period of 10 years (2006-2015). It was found that UHI intensity (UHII) varies diurnally with similar patterns in both seasons. UHII is relatively high during nighttime and relatively low during daytime. Dry-season UHII is approximately normally distributed but wet-season UHII is slightly heavy-tailed to the left of distribution. To look into UCI more closely, UHII was partitioned into 3 cases (UHI ≥ 0: non-negative, UHII < 0: mildly negative, and UHII < −1: largely negative). Negative UHII is present at all hours and becomes most intensified in the mid-afternoon (16 LT) in both dry and wet seasons. The times of day at which (very) negative UHII events found most (about 90% or larger, of all events) are 10-19 LT, with the peak time found at 16 LT. To examine the roles of certain weather variables in negative UHII, the average values of each of cloud cover, rain, urban wind speed and found that the difference between the mean of cloud cover at the urban station and that at the rural station changes substantially for the dry season, i.e., consistently increasing from UHI ≥ 0, UHII < 0 to UHII < −1. The differences in mean for cloud cover between the two stations are statistically significant but no such substantial changes were seen in the other weather variables. These help suggest cloud cover as a potential controlling factor for negative UHII in the dry season. For the wet season, no suggestion can be readily drawn.

***Keywords*:** urban heat island; urban cool island; cloud cover; temperature; urbanization

Cuttlebone: Environmental Friendly Technology for Heavy Metal Removal and Its Application in Battery Wastewater Treatment

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Paper # No. I-12-P

Abstract

Heavy metals (Pb, Cr, Ni, Zn, Mn and Fe) are contaminated in battery wastewater and caused various problems in the aquatic environments. Therefore, using abundance biomass is alternative adsorbent for removing heavy metals with high efficiency and economical cost. In this presentation, an internal shell of cuttlefish or cuttlebone (CB) was studied in Pb (II) and Cr (III) adsorption. The optimum initial pH of solution, optimum of contact time and maximum capacity from Langmuir isotherm were evaluated in batch experiment with single metal solution. The results found that Pb (II) and Cr (III) adsorption were optimum in solution initial pH 4.0 and 6.0, respectively. The metals adsorption equilibrium was found in 240 minutes for Pb (II) and 15 minute for Cr (III). According to Langmuir isotherm, maximum capacities (q_m) of CB were 869.67 mg/g for Pb (II) (R^2=0.933) and 555.56 mg/g for Cr (III) (R^2=0.994). The application of CB in battery wastewater treatment also tested by augmenting CB 0.2-1.0 g to dissolved battery wastewater pH 4.0. As a result, cuttlebone is an effective bioadsorbent, constituting a promising, efficient, low-cost, and eco-friendly technology for reducing heavy metals in battery wastewater treatment.

***Keywords*:** cuttlebone; biosorbent; heavy metals; battery wastewater

The Critical Load of Acidity of Surface Water in Vajiralongkorn Reservoir Kanchanaburi Province

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Paper # No. I-14-P

Abstract

In Thailand, the emission of acid forming compounds has increased significantly during last decades. They either come from natural or anthropogenic emissions, such as SO_2 and NOx, occur during the combustion of fossil fuels. This paper estimates the critical load (CL) of acidity for Vajiralongkorn reservoir by using first order acidity balance (FAB) model. The calculation bases on steady state mass balance between sinks and sources of sulphur and nitrogen in catchment area. Because the uncertainty can affect the critical load estimation, the distribution of all input data and parameter should be considered. These include 1) catchment area was approximately 5068 km^2, 2) forest in catchment area was approximately 3959 km^2, 3) lake area was 388 km^2 and 4) sulphur and nitrogen deposition were .1270 and 87.9 eq $ha^{-1}yr^{-1}$, respectively, 5) annual runoff was 0.64 m yr^{-1}, 6) nitrogen uptakes was 10 keq $ha^{-1}yr^{-1}$, 7) base cation concentrations at pre-industrial was 1.25 eq m^{-2}. Depending on input data and their uncertainty, the critical load of acidity in Vajiralongkor reservoir was 6.35 keq $ha^{-1}yr^{-1}$.

Keywords**:** critical load of acidity; sulphur and nitrogen deposition; Vajiralongkor reservoir; first acidity balance (FAB) model

Light Factors Affecting Antioxidant Production and Growth of Sprout Sunflower

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Paper # No. I-16-P

Abstract

This study aims to study on light effected to antioxidant production and growth of sprout sunflower. Conditions of light were varied in light type (white, blue, red and yellow), light intensity (high, middle and low), light source (LED and T8), and light period (0, 6, 12 and 24 hours). Total phenolic compounds, analyzed by Folin-Ciocalteu method, were used to represent amount of antioxidant in sprout sunflower and measure of biomass, height and germination, were used to represent amount of growth after 7 days plantation. The result indicated that LED and T8 on white and blue lights under all light intensity produced highest total phenolic compounds (1.73 - 5.09 mg GAE/g) while at 6 and 12 hours lighting period a day were not significant difference. LED and T8 on red light under all light intensity found maximum yield of biomass (5.73 – 8 %). In addition, LED and T8 on blue light under all light intensity were maximum yield of height and germination (13.46 – 17.89 cm, 74 – 102 trees). In this study, soil did not affect to antioxidant production and growth in sprout sunflower because the amount of nutrients in soil were sufficient to meet the needs of plant. This work revealed that optimum light condition stimulated more total phenolic compounds and growth of sprout sunflowers that could effective and ultimate beneficial to the consumer.

Keywords**:** total phenolic compounds; light intensity; light period; T8; LED

A New Mechanical Compressed Trash Can for Waste Volume Minimization

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Paper # No. I-18-P

Abstract

The amount of garbage produced of each day currently has more than the capacity of the trash can. One of the methods to solve the system for collecting solid wastes is to use the trash can which is able to increase the amount of waste discarding into the tank more in order to reduce the waste collection frequency. The objective of this research is to invent the mechanical compressed trash can to reduce the waste volume generated. Solid wastes in KMUTNB, Rayong campus were collected and analyzed the waste types. The operational performance of the compression of the invented trash can was investigated. The results showed that using the compressed trash can, compared with using the conventional trash can, could collect the wastes of plastic bags, plastic bottles and mixed wastes more than a 3.4, 2.0, and 2.1 times, respectively and contributed to reducing GHG emissions per year of waste collection vehicle to 70%, 50%, and 53%, respectively.

***Keywords*:** mechanical compressed trash can; waste volume; waste minimization; waste collection

A Comparison of the Effect of Effective Microorganisms Application in Aeration Tank of Activated Sludge System from a Sausage Product Production Factory

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Paper # No. I-19-P

Abstract

Different wastewater quantity and wastewater collection duration for treating pH, biological oxygen demand (BOD), suspended solids, and grease & oil for wastewater treatment from a sausage product production factory in aeration tank of activated sludge system (AS) was investigated using Effective Microorganism (EM) with and without sand filter in the final treatment by using wastewater samples from a sausage product production factory in Phitsanulok Province. The study showed that the efficiency of EM without sand filter in the final treatment for wastewater treatment with different wastewater quantity of the second to the fourth experiment was average pH at 7.6, 7.625 and 7.575; average BOD of 65.94%, 66.48% and 61.85%; average suspended solids of 96.50%, 96.39% and 95.42% and average grease & oil of 61.01%, 71.66% and 65.19%, respectively. And the efficiency of EM with sand filter in the final treatment for wastewater treatment with different wastewater quantity of the second to the fourth experiment was average pH at 7.525, 7.55 and 7.5; average BOD of 74.15%, 74.03% and 73.14%; average suspended solids of 96.37%, 97.21% and 96.87%; and average grease & oil of 78.28%, 86.65% and 92.91%, respectively. The efficiency of EM for wastewater treatment of 4 parameters and according to different wastewater collection duration of 4 parameters of the both have and haven't sand filter in the final treatment were statistically insignificant difference, but the efficiency of EM with sand filter more than without sand filter in the final treatment. The wastewater quality from this factory did not meet standard levels of the Promulgate of Ministry of Industry Issue No.3 B.E.2539, except pH. The wastewater treatment cost by using EM in the fourth experiment was lower than the other experiments.

***Keywords*:** effective microorganism (EM); aeration tank; activated sludge system (AS); sand filter; wastewater treatment; sausage product

Utilization of Citric Acid Manufacture Residue for Producing Mortar and Insulation

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Paper # No. I-20-P

Abstract

At present, there are various ways for industrial waste management. For instant, waste can be reused as an alternative material for the products to replace natural resources. This study investigated the suitable citrogypsum proportion for cement mortar and insulation products. For cement mortar, at ages 28 days, cement : sand : water ratio was 1 : 3 : 0.5 and cement was replaced by 25% (G25) and 50% (G50) of citrogypsum, the average value of compressive strength of G25 and G50 were 16.21 MPa and 6.41 MPa. For insulation properties, thermal conductivity, thermal diffusion and specific heat were 0.39 W/mK, 0.34 mm^2/s and 1.14 MJ/m^3K, respectively. However, a flexural strength was lower than standard, according to EN 13279 (1 MPa). In conclusion utilization of citrogypsum utilization is suitable to use as a raw material in producing insulation.

Keywords**:** citrogypsum; cement mortar; insulation; waste utilization

Effect of *Trichoderma asperellum* Culture Conditions on Inhibition of Plant Pathogens and Kinds of Bioactive Compounds

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Paper # No. I-21-P

Abstract

Plant diseases are a major limiting cause in yield loss of agricultural production. Using of chemical microbiocides in plant disease control is harmful to human and environment. Therefore, the biological control is required. This study was investigated the effect of the culture conditions of *Trichoderma asperellum* culture on the production of bioactive compounds and the inhibition of plant pathogens. *T. asperellum* was isolated from soil of the naturally grown bamboo in Songkhla Province, Southern Thailand (accession no. LC152196). It was cultivated in 20% PDB broth for 28 days at 30 °C in the static and the shaken conditions (100 rpm). The culture broths were extracted using ethyl acetate and the crude extracts were used to evaluate the minimum inhibition concentration (MIC), minimum fungal concentration (MFC) and minimum bacterial concentration (MBC) with 7 fungal plant pathogens (*Rigidoporus microporus*, *Aspergillus parasiticus*, *Fusarium culmorum*, *F. merismoides, F. oxyporum f.* sp*. gladioli, Verticillium albo-atrum* and *V. dahlia*) and 3 bacterial plant pathogens (*Agrobacterium tumefaciens, Erwinia carotovora* subsp. *carotovora* and *Xanthomonas oryzae*) by resazurin microtiter plate assay. The crude extract was analyzed by gas chromatography mass spectrometry (GC-MS). The result indicated that the crude extract from the static culture inhibited plant pathogens more than the crude extract from the shaking culture. Seven compounds (Cyclohexene-1-Methyl-4-(1-methylethenyl), 4H-pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl, 5-Hydroxymethyl, 2-Furancarboxaldehyde, 6-Pent-1-enylpyran-2-one, 1,2-Benzenedicarboxylic acid, dibutyl ester, 9,12-Octadecenoic acid and Pyrrolo[1,2-a]pyrazine-1,4-dione, hexahydro-3-(phenylmethyl)) from the crude extract of the static culture were reported to have many activities such as antimicrobial, anticancer and antioxidant etc While only one compound from the crude extract of shaken culture as 1,2-Benzenedicarboxylic acid, dibutyl ester was reported to have a bioactivity.

***Keywords*:** bioactive compounds; resazurin assay; plant pathgens; *Trichoderma asperellum*

A New Challenge of Forest Role in Attacking Climate Change

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International Convention and Commitment Section
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Paper # No. II-1-i

Abstract

Thailand endorsed the New York Declaration on Forests during the Climate Change Conference taken place in Paris (COP21), 2015. The Royal Forest Department under the Ministry of Natural Resources and Environment of Thailand has been mandated as a national focal point for the New York Declaration on Forests. In pursuing the New York Declaration on Forests, the RFD, on behalf of the Thai Government, has to cope with national forest targets as set out under the Sustainable Development Goals (SDGs) to be achieved within 2 phases--natural forest loss needs to be cut in half by 2020 and strive to end it by 2030. In addition to that, the reduction of forest degradation and deforestation can be considered as a key mechanism for strengthening climate change mitigation and adaptation. The increase in national forest covers will also help enhance sink capacity from forestry sector. In fact, the framework of the New York Declaration on Forests has been designed to achieve two main targets under SDGs 13 (climate change) and SDG 15 (forest landscape). Integrative mandate

With regard to the endorsement of the New York Declaration on Forests, there is a challenging task for the RFD to be taken into account. An integrative approach among international conventions relating to forest needs to be added up into national forest policy and action plan. Three areas of international conventions relating to forest resource include the United Nations Convention Framework on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), and the United Nations Convention to Combat Desertification (UNCCD). Integrating the three forestry-UN Conventions in an active manner can introduce synergistic impacts on a true concept of sustainable forest management (SFM).

In achieving the 2nd milestone of the New York Declaration on Forests, the RFD has to employ meaningful components of best practices either domestically or internationally into national implementation. Various elements of SFM are still required in practical level. The implications are be considered as an integrative devise being used to synergise the forestry-related conventions including UNFCCC, CBD, and UNCCD. Particularly, the relationship between forest area and carbon sink capacity has been drown into global attention in reponse to climate mitigation and adaptation. The global community therefore realises that national forest cover must be increased while carbon sink capacity should be also enhanced.

In this connection, I have learned that the UNFCCC will organise an annual forum on climate change conference in Bonn, Germany between 16 - 26 May 2016. I am very much interested in taking part in the mentioned conference as many implementable issues proposed within the New York Declaration on Forests are under the negotiation process i.e. REDD+ mechanism, INDCs, market and non-market mechanism.

Please note that the RFD has to take this responsibility in an urgent period while we did not make the budgetting plan for this purpose in 2016. I am therefore still lacking of funding support to travel to Bonn, then would like to assist you in this regard. Please kindly advise how to seek the sponsor for my participation. I have been informed that some grants have been provided for developing countries to be engaged in international conference under a programme of gender participation in climate negotiation. I am wondering whether the programme is still active or any other programmes I could access please also kindly suggest.

How to Actively Engage Society in Environmental Policy and Management: The Dutch "Green Deal Approach" as an Example of Addressing Effectively the Prevention of Littering and the Removal of Litter in the Coastal and Marine Environment

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Paper # No. II-2-i

Abstract

Environmental problems are vast and addressing these by imposing legislation and law enforcement alone does often not solve the problem effectively. Another option is present: engage the stakeholders who are either responsible for the pollution and those who could help prevent or cure this and thus making them part of the Environmental Policy Cycle process. This is what is practiced in the Netherlands for a number of years, the so called "Green Deal Approach". In this approach the National government with stakeholders are linked to an environmental problem and together solve that problem. Three maritime Green Deals, are presented in this article: Green Deal Fisheries for a Clean Sea, Green Deal Ship Generated Waste and the Green Deal Clean Beaches. In these Green Deals stakeholders participate actively, which creates support for this policy approach. It also leads to new insights and ideas for environmental measures. The Green Deal approach is an innovative way to include society to solve environmental problems. In this initiative, the national government is no longer the manager of the environmental policy processes but fosters a bottom up approach, allowing society to participate and to act and address environmental issues. This approach, together with communication, economic and legal environmental instruments that are in place, addresses environmental problems on a more acceptable and effective way.

***Keywords*:** environmental policy; public participation; network management; Green Deal Approach; Green Deal Fisheries for a Clean Sea; Green Deal Clean Beaches; Green Deal Ship Generated Waste; marine pollution; plastic soup

Spatial Heterogeneity of Heavy Metals and Risk Assessments in the Mae Klong River Estuarine Ecosystem

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Paper # No. II-1-O

Abstract

The Mae Klong River estuarine ecosystem has been under various pressures by anthropogenic and natural factors. One of the immediate consequences of such disturbances is heavy metal contamination whose degree has not been comprehensively evaluated in this ecosystem. Here, we sampled water and sediment in 28 stations within the main area of the estuary and a set of heavy metals was divided into Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb in the water, sediments and organisms in order to assess the contamination status, ecological and health risks. The contamination status of heavy metals in the surface water was found in order of Zn>Fe>Mn>Cr>Ni>Co>Cu. Level of heavy metals onto the bottom water was discovered as Fe>Mn>Zn>Cr>Pb>Ni>Cu>Co. The accumulation of heavy metals in the surface sediments was in order of Fe>Mn>Zn>Cr>Cu >Pb>Ni>Co. The potential toxicity was evaluated as the ecological risk on the surface sediment by quality guidelines (SQGs), enrichment factor (EF) and geo-accumulation index (Igeo). Results of SQGs comparison showed that only Mn (averaging 821.0 mg/Kg) is concerned that it may occasionally be associated with adverse biological effects. Based on the used criteria, the risks of Ni and Cu were unclear and thus need to be examined by other approaches. Metals including Cr, Mn, Zn and Pb were not associated with adverse biological effects. Ecological factor values showed that Mn (ranging 3.27-9.35) and Pb (ranging 0.44-3.87) were concerned with moderate to significant enrichment, whereas EF values of Cu and Zn indicated that they were not at pollution levels. The calculated target hazard quotients (THQ) and total target hazard quotients (TTHQ) were less than 1, thus the intakes of Cu and Zn by consuming mollusks from the Mae Klong River estuarine ecosystem did not result in a ratable hazard risk on health.

***Keywords*:** heavy metals; ecological risk assessment; health risk assessment; the Mae Klong River estuarine ecosystem

Spatial and Temporal Variation of Seawater Qualities and Indigenous Benthos along the Northern Gulf Of Thailand from Chonburi to North Pattaya

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Paper # No. II-3-O

Abstract

Marine ecology caused severe risk to degenerate from urbanization, industrialization, agriculture and tourism. The coast line was the vulnerable areas where directly receiving discharges from anthropogenic activities. The study areas were the nearby coast line along the Upper Gulf of Thailand from Chonburi to Pattaya (approximately 55 kms) in which the famous beaches, the aqua farms, deep sea as well as local fishery ports and industrial estates were located. Thus, the spatial and temporal variations of seawater qualities were determined in terms of marine resource usage, management and conservation. The physical parameters were determined at each half depth below the sea level. Water temperature ranged from 30.00 – 31.40 and 28.40 – 29.30 ºC; DO 4.93 – 7.60 and 5.10 – 6.54 mg/L; pH 7.97 – 8.36 and 7.98 – 8.10; salinity 32.05 – 32.77 and 32.35 – 32.70 psu in rainy season and winter, respectively. The sediment samples were collected by Ekman dredge and scuba diving with. 0 – 10 cm depth. The other seawater qualities were determined by modification from Standard Methods for Water and Wastewater. BOD in the two seasons (0.1 – 1.56 and 0.3 – 2 mg/L) were agreed with Standard values. The variation was affected by muddy pier at Fish dock, tourism activities at Bangsaen beach Bangpra and Banglamung community wastewater discharge. The organic contents in wastewater were clearly originated from anthropogenic activities. High contents of COD were found at sta. 3, 4, 6 and 7 where the population communities, shipping and local fishery ports were located. COD were ranged from 7.35 – 205.88 and 198.66 – 377.48 mg/L, respectively. FOG varied very wide range in winter (7.13 – 273.40 mg/L) and higher than in rainy season (0.09 – 35.60 mg/L). The higher amounts were found in Wastewater discharge, Bangpra, community and the local fishery port at Sri Racha pier. Low PO_4^{3-} and TKN were observed for all stations (0.01 – 0.09 and 0.16 – 0.59 mg/L). The higher contents were found in muddy and water discharge areas. Sulfide ion varied from 0.15 – 0.53 mg/L.

Among heavy metals in sediment, the highest amounts of Fe (4.2 ± 0.18 and 8.3 ± 0.86 g/kg) were observed in the rainy and winter season, respectively. Mn was the component of anti-corrosion as coating agent, it was found for the second most metal in the sediment around Shipyard (Laem Chabang pier). Pb was the third probable found at the Sanctuary of Truth, Bang Lamung and Sri Racha pier with similar quantities (260.69 ± 8.42, 233.21 ± 7.13 and 205.74 ± 8.20 mg/kg, respectively) from spraying of primer containning lead oxide. In winter, Cr which was the coating for protection metal oxide formation was the second probably at Sri Racha shipping area, Laem Chabang pier and Wastewater discharge, Bangpra: (1.2 ± .13, 0.93 ± 0.32 and 0.69 ± 0.15 g/kg, respectively). Mn was found in the third amount at Fish dock and Sri Racha pier: (0.59 ±0.13 and 0.36 ± 0.01 g/kg). The higher contamination of heavy metals was found at the deep-sea port and industrial estate than the beach, aquaculture farms, communities and local fish dock. The amount metals were Pb > Hg > Cu > Cd > Ni > Zn > Cr. The highest was found at Sri Racha pier followed by Wastewater discharge, Bangpra. The former may be contaminated from the source itself. The later may be enhanced by adsorption of metals on high organic matter from wastewater. The same phenomenon was observed for Pb which was originated at Bang Lamung and accumulated at the Sanctuary of Truth. The polychaete *Nereis* sp. was the dominant species in rainy season at Wastewater discharge, Bangpra and the bivalve *Lucina* sp. was dominant species in winter and summer at Wornnapa beach and Wastewater discharge, Bangpra. Annually diversity index was highest at Sri Racha pier valued 1.0985 and lowest at Bang Lamung valued 0.35163. The relationship between marine water qualities, sediment characterization and benthic composition should be observed continuously to monitor and warning for pollution impact in marine ecosystem.

Keywords**:** spatial and temporal variation; seawater qualities; heavy metal accumulation; benthos; diversity index; Gulf of Thailand

Gastrointestinal Parasitic Species of Gaur (*Bos gaurus*) and Native Breed Cattle (*Bos taurus indicus*) between Transition Zones of Conservation Area in the Northeast, Thailand

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Paper # No. II-4-O

Abstract

The parasitic infections exhibit a significant factor on the population of the wildlife and it is a critical issued in the conservation of threatened species of wildlife. In this study, the potential risk of gastrointestinal parasitic prevalence and transmission between the vulnerable species of Gaur (*Bos gaurus*) and native breed cattle (*Bos taurus indicus*) in the transition zone between the Khao Pha Ma Non-hunting Area, Northeast of Thailand were determined. Fresh fecal samples were collected from both species and examined by carpological examinations. Total 34 fresh fecal samples from gaur and 9 fresh fecal samples from domestic cattle were examined. It was found 3 gastrointestinal parasitic species including 2 species of nematode and one species of trematodes. The overall results of gastrointestinal parasitic prevalence rates of strongylus, strongyloides and paramphistomum were 46.51%, 13.95%, and 4.65%, respectively and total gastrointestinal parasitic prevalence rate was 51.16%. The average parasitic egg per gram of feces was 110 (range: 50-550) eggs/gram. Single gastrointestinal parasitic infection rate was 72.72% and eggs/gram rate was 76 (range: 50-200), and multiple gastrointestinal parasitic infection rate was 27.27% and eggs/gram rate was 203 (range: 50-550). The study showed that the prevalence rate of gastrointestinal parasitic infection was higher at gaur due to lack of deworming and nutrition but more gastrointestinal parasitic species found in domestic native cattle due to ineffective management of cattle production system. Following activities will be recommend to control gastrointestinal parasitic infection in gaur: artificial salt lick with nutrient supplement, management of grassland, and barrier between forest and agricultural area.

***Keywords*:** gaur; gastrointestinal parasite; strongylus; strongyloides; paramphistomum

Distribution of Mercury in Water, Suspended Solid and Sediment in Chao-Phraya River Mouth Area

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Paper # No. II-6-O

Abstract

Mercury contamination in the Gulf of Thailand (GOT) has been monitored regularly by the Pollution Control Department of Thailand and the results have been published in the annual monitoring reports. Based on the reported data since 1999 until present, the total mercury level in the GOT never exceed Thailand's seawater quality standard. However, there were reports of episodic mercury contamination in certain locations that exceed the established environmental quality standard. In this study, water, suspended and bottom sediment samples from 25 sampling stations located in the delta of Chao Phraya River were collected twice during the high discharge period (January) and low discharge period (July) in 2016. The samples were analyzed for concentrations of mercury in water, suspended solid and sediment, and related water quality parameters. The results from this study indicated that in water samples, total mercury and dissolved mercury concentrations were almost at the same level, although much higher concentrations of mercury were found in the suspended solid, because water samples had relatively low suspended solid concentrations. Higher fraction of HgS (less bioavailable fraction) was found in the suspended solid in comparison to the sediment. Moreover, the results also indicated that although the average concentration of mercury was higher during the low flow period, the estimated total flux of mercury during the high and low flow periods were in the same order of magnitude.

Keywords**:** discharge; heavy metal; monitoring; pollution

Seasonal and Land Use Effects on Amphibian Abundance and Species Richness in the Sakaerat Biosphere Reserve, Nakon Ratchasima

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Paper # No. II-7-O

Abstract

Protected areas cannot completely sustain biodiversity, thus understanding the role of human-disturbed areas in conserving the world's diversity is critical. Despite intensive deforestation, Southeast Asia is underrepresented in studies investigating faunal communities in human-modified landscapes. This project assessed the herpetofaunal community in dry dipterocarp forest, secondary disturbed forest, and *Eucalyptus* plantations in the Sakaerat Biosphere Reserve. In May, June, and September of 2015, we surveyed using 10 passive trapping arrays. Both the *Eucalyptus* plantations and secondary disturbed forest habitats (224 and 141 individuals, respectively) had higher amphibian abundance than the dry dipterocarp forest (57 individuals), but we observed significant seasonal variation in amphibian abundance. During the wetter month of September, we recorded higher numbers of amphibian individuals and species. In particular, we noted that distance to a streambed influenced amphibian abundance during the rainy season. The three most abundant species in May and June were *Microhyla fissipes*, *Fejervarya limnocharis*, and *Microhyla pulchra*. In September, the three most abundant species were *Microhyla fissipes*, *Glyphoglossus molossus*, and *Kaloula mediolineata*. Our findings suggest that seasonal resources should be considered when conducting monitoring programs and making conservation decisions for amphibians.

***Keywords*:** amphibians; conservation; seasonal patterns; protected area management

Contribution of Root Respiration to Soil Respiration during Rainy Season in Dry Dipterocarp Forest, Northern Thailand

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Paper # No. II-8-O

Abstract

Soil carbon dioxide (CO_2) from root respiration (R_r) was about 10-90% of soil respiration, depends on the spatial variation. Dry dipterocarp forest has clearly separate season. Rainy season is a period by higher root growth than dry season which affect to root respiration variability over the drought. The study of R_r in Thailand was less information because the separating root and microbial respiration from total soil respiration (R_s) is difficult. This study aims to estimate R_r and analyze environmental factors affect to R_r during rainy season in dry dipterocarp forest, northern Thailand. The results show that R_r ranged from 41.04-61.97 $mgCO_2/m^2/hr$ and ratio of R_r to R_s was 23-48%. The response of R_r to environmental factor found that soil temperature has weak negative relation with R_r and soil moisture is a main driver for emitted soil CO_2 from root in rainy season. However, long period study and root biomass will improve accuracy and understanding for root respiration in the future.

Keywords: root respiration; soil respiration; dry dipterocarp forest

Pollution Status and Potential Ecological Risk Assessment of Heavy Metals in Soils from a Municipal Solid Waste Open Dumpsite in Thailand

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Paper # No. II-9-O

Abstract

The aims of this study were to determine the pollution status of heavy metals in soil taken from Nakhonluang district municipal solid waste open dumpsite of the Phra Nakhon Si Ayutthaya province in Thailand and to assess the potential ecological risk of the area. Contamination factor, geo-accumulation index and potential ecological risk index were used as analytic tools for the assessment of the pollution status and the potential risk of the heavy metals to environment. The concentrations of 8 heavy metals were determined by atomic absorption spectrophotometer (AAS). The average concentrations of each metal from soil inside the dumpsite area were higher than those in the outside area and they were in the following order: Fe >> Mn > Zn > Cu > Cr > Ni > Pb (Cd was not detected). Contamination factors and geo-accumulation indices of heavy metals were found in the following order: Zn > Cu > Ni > Cr > Pb (Background concentration values of Fe and Mn are not available). The values showed a strong contaminated level for Zn in soil inside the dumpsite area and uncontaminated level for Pb. The potential ecological risk index (RI) in the dumpsite area showed that it generated moderate risk degree to environment and the RI value obtained from inside the dumpsite area was higher than those in the outside area. The results indicated that the dumpsite contains toxic substances that cause adverse effects to the environment. The potential ecological risk obtained in the order of $E_r^{Cu} > E_r^{Ni} > E_r^{Zn} > E_r^{Cr} > E_r^{Pb}$ demonstrated that Cu is the most important factor leading to risk.

***Keywords*:** heavy metal; open dumpsite; contamination factor; geo-accumulation index; potential ecological risk assessment; soil contamination

Differentiation of Mangrove Ecosystem alongside of River Bank along Same Latitude in Ayeyarwaddy Delta Coastal Zone, Myanmar

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Paper # No. II-11-O

Abstract

Mangroves in Ayeyarwaddy Delta Coastal Zone were annually degrading due to human and natural pressure. Species composition and tree density were driven by natural phenomena including tide inundation, soil and water quality, ground elevation, and community needs. Marketable and daily needed species are decreasing more than lesser known species. Diverse species distribution is crucial for maintaining a healthy and sustainable mangrove ecosystem. This research was conducted to understand mangrove species zonation due to hydrology and water quality alongside of river bank along same latitude. Research methods include biomass measurement, species identification, and water quality experiment in consideration of hydrology and topography in 4 transact lines composed of 6 sample plots in each situated along the same latitude. Different species were recorded in different plots of each transect line; *Herriteria fomes* among 4 species in transect A, *Avicennia alba in* transect B, *Dolichandrone spathacea* in transect C, *Dolichandrone spathacea* in transect D. Salinity in positive trend from 5.67 ppt (PSU) to 4.97 ppt (PSU) along transects A and B from 5.32 ppt (PSU) to 4.90 ppt (PSU) along transact line B in landward direction. Dissolved oxygen contents (DO) were observed in negative trend from 4.40 to 4.33 g L^{-1}. And, surface water temperature was observed in positive trend in transect A; from 29.30 to 29.54 C but negative trend in transect 2 from 28.71 to 28.65 C. All together 19 tree species including one terrestrial tree (*Albizia lebbek*) were observed. *Avicennia officinalis* followed by *Heritera fomes* among 19 tree species along four transect lines were recorded as dominant species. Transect B and D were receiving longer inundation period of 45 minutes to one hour while transect A was receiving spring tide less than one hour and transect C was not receiving spring tide due to their ground elevation above MSL. In the context of fauna, mangrove tree crab "*Aratus pisonii"* were mostly observed in transect A and B while swimming crab "*Macrophthalmus depreaua*" were observed in transect C and D. The study proved that mangrove plant species composition and its ecosystems were likely to be driven by ground elevation, soil and water quality, maximum tide water inundation frequency, temperature, and precipitation. Fauna species composition, soil properties, and sedimentation rate should be observed in depth as well from more understanding mangrove ecosystem difference in Ayeyarwaddy Delta Coastal Zone.

***Keywords*:** mangrove; reserved forest; water quality; zonation; hydrology; topography

Spatial Distribution of Soil Carbon and Nitrogen in the Intertidal Mangrove Forest

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Paper # No. II-2-P

Abstract

Mangrove forests are among the most important carbon sink for the atmospheric carbon dioxide and very productive ecosystem services in the world. They are easily exposed to anthropogenic activities and contamination from sea-based and land-based sources. Spatial distribution of carbon and nitrogen is important for ecosystem management. This study was conducted along the drainage area of the Nature Education Center for Mangrove Conservation and Ecotourism in Chonburi Province, Thailand. A total of 32 soil samples were collected across the area and were divided into the top (0-5 cm) and bottom (5-10 cm) soil layers. This study aimed to: 1) assess a spatially explicit of total carbon (TC) and total nitrogen (TN), 2) investigate C:N ratios at the different depths, and 3) identify soil characteristics controlling factors of TC and TN. The results showed that the majority of soil texture was sandy clay loam at the top and mainly clay at the bottom layers. Soils contained an average of TC accumulation of 2.80±1.49% in the top soil layer and 2.30±1.60% in the bottom soil layer. Average TN contents were 0.18±0.04% in the top soil layer and 0.15±0.03% in the bottom layer. The estimated amount of mean TC with standard deviation at a 10 cm depth was relatively high (3.12±1.50 kg C/m^2) when compared to previous studies in subtropical wetlands. In terms of spatial variability, the high TN values were distributed in mangrove areas near the community and decreased from land to the sea. The dissimilar spatial patterns between TC and TN indirectly entailed non-linear relationship between TC and TN. In this study, the C:N ratio of the top soil layer ranged from 0.09 to 40.53, with an average of 16.50. The C:N ratio in the bottom soil layer was lower, ranging from 0.11 to 27.19, with an average of 15.24. Salinity, electrical conductivity (EC), and total dissolved solids (TDS) showed weak correlations with TC and TN. In addition, TC and TN in the top layers also revealed a weak relationship with R=0.20(p-value < 0.01), while stronger linear correlations were discovered in the bottom layers with R=0.54 (p-value < 0.01). These interconnections could be explained by non-linear structures which coincided with the results from spatial analysis.

Keywords**:** mangrove forest; soil carbon; soil nitrogen; spatial

A Hybrid Input-Output Model for Analyzing: Agricultural Wastewater in Thailand

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Paper # No. II-5-P

Abstract

Thailand is considered one of the world's top agricultural countries since the land and the climate are suitable for agriculture. Agricultural activities including cultivation, livestock farming and fisheries require water as a main resource. The water used in agriculture causes large amounts of wastewater which is contaminated by cultivated fertilizer and farm waste. The wastewater has various impacts on environment; for instance, worsening water quality, reducing soil fertility as well as being harmful to users' and consumers' health. Using the study of Thailand's agricultural economy in 2010, we present a model for factors of production and hybrid production of the volume of agricultural wastewater in Thailand. This study aims to determine the volume of wastewater and the cost of wastewater occurring in the economic system in an agricultural sector. The table illustrating factors of production and hybrid production is the instrument which connects and explains the dimension of relationship between economy and environment. The result indicates that in one baht Gross Domestic Product (GDP), rice cultivation releases the highest wastewater volumes owing to the fact that rice plantation uses large amounts of water and fertilizers. Another reason is that rice is the major crop in Thailand and thus grown in significant quantity.

***Keywords*:** hybrid input-output table; agricultural wastewater; Thailand

Case Studies of Major Solid Waste Landfills in Thailand, Cambodia and Laos– Leachate and its effects of Surface Water and Groundwater Environments

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Paper # No. III-1-i

Abstract

Solid waste is one of the major environmental concerns in modern society. Especially landfill leachate normally contains a various harmful chemical, which could contaminate the surface water and ground water. Therefore proper landfill management and operation are of vital importance for protecting the water environments. However due to lack of good practise of waste management, the landfill or waste dumping facility is one of the typical contaminant source. The risk of contamination of the water environment depends on many factors, such as, the quality and quantities of leachate, the geographical and geological conditions of landfill, and landfill management. Collaborative researches are conducted on three solid waste landfills in three major cities of IndochinaPeninsula, namely, Nontaburi province, Thailand, Phnom Penh city, Cambodia and Vientiane city, Laos. Various site investigations have been done, such as on-site measurements and laboratory chemical analyses for the various samples, leachate, ground water, surface water, sediments. From the data obtained at different time and sites with common and different site conditions, characteristics of leachate and factors affecting the properties are discussed, such as waste age, landfill pit depth, waste thickness, cover soils, precipitation. Furthermore the long term risk of the groundwater contamination is discussed from the observation and numerical simulation to identify the critical conditions for preventing the future risk.

***Keywords*:** solid waste; landfill operation; leachates; groundwater

Effects of Headwater Dams on Organic Matter Decomposition in the Stream Channel and the Hyporheic Zone

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Paper # No. III-2-i

Abstract

Headwater ecosystems largely depend on allochthonous organic matter, and the retention and processing of the organic matter is essential in understanding the headwater ecosystem processes. Headwater dams alter the channel environments, and their effects on the dynamics of organic matter are of concern. In this study, we examined the seasonal variation in the organic matter decomposition, downstream of the dams, both in the wetted channel and hyporheic sediments. We studied three headwater dams and used the cotton-strip assay method to evaluate organic matter decomposition rate. To observe the seasonal variation, the decomposition rates were measured 5 times in 2016, and to evaluate the contribution of aquatic invertebrate, we used two different mesh sizes housing the cotton-strips. The results revealed that the decomposition rate was slower at the downstream of reservoirs compared to the upstream reach and the nearby tributary without a reservoir in all seasons. Though water temperature was consistently warmer, the inorganic nitrogen concentration and the contribution of aquatic invertebrate were lower at the downstream of the reservoir, which contributed to the lower decomposition rate at the downstream sites. When the wetted channel and streambed sediments were compared, the decomposition rate in the streambed sediments were lower, except for winter time, suggesting that streambed sediments become important location for decomposition in winter.

An Assessment of Climate Variability on Farmers' Livelihoods Vulnerability in Ayeyarwady Delta of Myanmar

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Paper # No. III-1-O

Abstract

This study identifies and locates the degree of farmers' household vulnerability in Ayeyarwady Region, Myanmar. Fifty-nine farmers' households were purposely selected for conducting questionnaire survey together with the secondary data conducted in 2016. In order to identify the variability of household vulnerability, the Livelihood Vulnerability Index (LVI), which was based on five capitals as identified in Sustainable Livelihoods Framework (SLF) was adopted and modified according to the context of the area. The vulnerable score ranged between 0 (low vulnerable) and 1(high vulnerable) and the overall LVI result obtained was 0.442, therefore, the study area was identified as the moderate vulnerability. In terms of capitals, the households were most vulnerable in terms of financial capital with the value of 0.530, followed by the natural capital (0.515), and the physical capital (0.418). The households were classified into three groups: low, moderate, and high vulnerable groups to understand where and who are likely to need special attention. The survey found that the vulnerability of each asset they suffered was different across the township. It is clearly seen that in order to reduce the vulnerability of farmers' livelihood, agricultural loan, divesifying livelihood activities, farm technology and inputs, infrastructure and enhancing their knowledge to crop failure should be provided.

***Keywords*:** livelihoods; vulnerability assessment; capitals; climate variability; Ayeyarwady Region

PM_{10} and $PM_{2.5}$ from Haze Smog and Visibility Effect in Chiang Mai Thailand

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Paper # No. III-2-O

Abstract

Air pollution from haze smog in Chiang Mai Thailand becomes a serious problem, particularly fine particulate matter FPM, PM_{10} and $PM_{2.5}$. These issues have effects on health, transportation and tourism. Visibility reduction effect has impacts on transportation safety and environment aesthetic scenery. In this study, the visibility impact was monitored by a digital camera, video records and aerial photography. The visibility images were analyzed both qualitative and quantitative methods including in the comparison with related information during with and without haze. The visibility lengths were directly measured by GPS and Google earth mapping. Visibility reduction from haze events were also compared by photograph image analysis in unit of Deciview. Fine particulate matter concentrations and frequency of fire, in Chiang Mai were associated with visibility. During forest fire occurring, deciview number was increased. In dry season, the frequency of fire (times) were correlated with both PM_{10} and $PM_{2.5}$ with r = 0.9 (95, % CI, $p < 0.05$). The reverse correlation (-r) between visual length (km) and PM_{10} and $PM_{2.5}$ were 0.64 and 0.72 at altitude 444 m with 95% CI, $p < 0.05$. The correlation (–r), at altitude 313 m was 0.93 for PM_{10} and 0.96 for $PM_{2.5}$ with 95% CI, $p < 0.05$. The correlation (–r), at altitude 324 m was 0.86 for PM_{10} and 0.93 for $PM_{2.5}$ with 95% CI, $p < 0.05$. The association between Visibility and FPM at low altitude was found more significant than at high altitude.

Keywords: PM_{10}; $PM_{2.5}$; haze smog; visibility; Chiang Mai

Flash Flood Risk Estimation of Wadi Qena Watershed, Egypt Using GIS Based Morphometric Analysis

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Paper # No. III-3-O

Abstract

Flash flooding is one of the periodic geohazards in the eastern desert of Egypt where many parts of Upper Egypt, Sinai, and Red Sea areas were hit by severe flash floods for example in 1976, 1982, 1996 and January 2010. The hazard degree for each sub-basin was determined using the approach which developed by El-Shamy for assessing susceptibility of sub-basins to flash flooding risk. To determine the hazardous sub-basins, two different methods are applied. The first method is based on the relationship between the drainage density and bifurcation ratio, and the second one uses the relationship between drainage frequency and bifurcation ratio. The three morphometric parameters (the bifurcation ratio, drainage density, and stream frequency) were extracted and calculated for each sub-basin of the watershed. Based on the final hazard degree resulting from the two methods, a detailed hazard degree map is extracted for all sub-basins. The results illustrate that there are not any sub-basins with low possibility of floods. The sub-basins with the highest hazard degree are concentrated in the middle of the watershed although they have smaller areas comparing with the surrounding sub-basins. The sub-basins located at the boundary of the watershed have an intermediate possibility for floods and moderate potential for groundwater recharge. This constructed map can be used as a basic data for the assessment of flood mitigation and planning.

***Keywords*:** morphometry; risk; flood hazard; groundwater recharge; eastern desert

Age and Evolution of Beach Ridge Plain from Chaiya Coast of the Gulf of Thailand

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Paper # No. III-4-O

Abstract

The main objective of this research was to study coastal evolution from Lam Pho, Chaiya District, Surat Thani Province, Southern Thailand. This research methodology started from satellite image interpretation for planning landform, field survey and locating sample collection for Optically Stimulated Luminescence (OSL) dating. As a result, beach ridges in this area were prograded continuously and formed as beach ridge plain alongshore. Oldest ridge is formed at 7,170 ± 460 years BP and youngest is formed at 570 ± 20 years BP. This result indicates that Chaiya coastal area including ridges and swales was formed as beach ridge plain and progradation in eastward direction during the regression from middle to late Holocene. Orientation of sand spit shows southeast direction indicating southeast longshore current.

***Keywords*:** beach ridge; optically stimulated luminescence dating; sand spit; sea level change

Morphometric Temporal Change Analysis for the River Nile Forced Bends Using RS/GIS Techniques: Case Study of Damietta Branch of the Nile River, Egypt

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Paper # No. III-5-O

Abstract

The river Nile is one of the longest rivers all over the world. Damietta branch, Egypt, is important as a major source of irrigation and navigational path from Cairo to the Mediterranean Sea. The morphological changes of Damietta branch have been occurred after Aswan High Dam construction which affected the sedimentation and erosion power of the flow especially on bends locations. In this study, morphometric temporal changes are investigated for the forced bends using Remote Sensing (RS) and Geographical Information System (GIS) techniques for a study period between 1987 and 2015. In addition, a comparative study was performed among three image classification techniques; onscreen digitizing, maximum likelihood classification and histogram thresholding technique. Field map for the river banks for the year 2000 was used to verify morphometric behavior of the forced bends extracted from the satellite images. The comparative study showed that the maximum likelihood classification technique has a good performance at shoreline detection with percentage error of 0.42 % compared with the observed data. Results show significant morphometric changes of the bank status for the studied forced bends. The forced bend named Sherpas was found to have the highest average annual rate of erosion with value of 1.62 m/year. The maximum average annual rate of sedimentation was located in the inner bank of Sawalem forced bend with a value of 1.0 m/year and that the maximum erosion and sedimentation rate achieved the greatest values within the period between 1987 and 1998.

***Keywords*:** Morphometric changes; forced bends; remote sensing; geographical information system; Damietta branch

Investigating Reef Contact Rates of Snorkel Visitors at Koh Sak, Pattaya on Guided and Non-Guided Coral Reef Tours

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Paper # No. III-6-O

Abstract

Recreational snorkelling is a popular activity at Koh Sak, Pattaya Bay and although most snorkel visitors to the island arrive by speedboat on guided tours many visitors come on tours that do not provide a guide. Because there is widespread agreement that reef-based tourism negatively impacts coral reefs it is important to understand the potential role guides play in reducing visitor impacts. From February to November 2015 and 2016 the author observed 421 snorkelers 35% of whom came on non-guided tours. For 10 minutes I recorded the snorkelers' distance from their guide (if they had one), the number of people in their snorkelling group, and the number of contacts with the reef to calculate a per person reef-contact rate. There was no difference in contact rate between males (0.09 contacts min^{-1}) and females (0.11 contacts min^{-1}) nor was there any difference based on the group size (2-7 people). However, contact rates for snorkelers on tours with no guide (0.09 contacts min^{-1}) and snorkelers far from their guide (0.08 contacts min^{-1}) were significantly lower than visitors who snorkelled near their guide (0.18 contacts min^{-1}; $P<0.001$).The contact rate of guides (0.36 contacts min^{-1}) was significantly greater than the snorkelers they were looking after (0.17 contacts min^{-1}) in part due to the lack of knowledge and experience of snorkelers and guides alike. To reduce negative impacts to the coral reefs of Koh Sak guides need to reduce their destructive behaviour and improve their knowledge of reef biology and ecology.

***Keywords*:** Koh Sak; coral reefs; recreational snorkelling impacts

Assessing the Sustainability of Ghanaian Cities: the Case Study of Accra Metropolitan Area

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Paper # No. III-8-O

Abstract

Cities have become integral in the quest to achieving universal sustainable development. For example, the United Nations in 2015 as part of the 17 Sustainable Development Goals called for cities and human settlements to be inclusive, safe, resilient and sustainable (Goal 11). Achieving a sustainable city requires continuous assessment of its development in line with the goals of sustainability. The aim of this study was to comprehensively evaluate the sustainability status of Ghanaian cities. As a case study the sustainability of Accra, the capital city of Ghana, was assessed using sustainable development indicators. Forty-one Accra sustainability indicators (ASI) were defined and classified into Economic, Environment, Social and Institutional dimensions. The evaluation was over the period of 4 years, from 2012 to 2015 during which the 2012 Urban Policy and its action plan were being implemented. The results show Accra's economic and social dimensions are approaching sustainability while environmental and institutional dimensions are performing poorly. Overall sustainability score of Accra however showed a progression towards sustainability over the last 4years, rising from 0.48 in 2012 to 0.51 in 2015. The findings of this study are helpful to local authorities for sustainable city planning and management.

***Keywords*:** sustainable city; sustainable development indicators; city sustainability assessment; Accra

The Use of Dredged Sediment from the Watsongpeenong Canal with Paper Mill Residue to Produce Facing Bricks

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Paper # No. III-9-O

Abstract

The potential to use dredged sediment from the Watsongpeenong Canal and paper mill residue as the primary raw materials for producing facing bricks was studied in the laboratory. Dredged sediment and paper mill residue were chemically, mineralogically, and thermally characterized using X-ray fluorescence (XRF) and X-ray diffraction (XRD). To evaluate the effects of the contents of the paper mill residue on pore-forming, large amounts of paper mill residue, ranging from 5 to 7% by mass, were blended with dredged sediments and fired at 700 ^{o}C. The physical-mechanical properties, including dimensions and tolerances, wryness, deviation of the right angle, water absorption, compressive strength, stain, hole, rails, and cracks, as well as the microstructural properties of the facing bricks, were investigated. In addition, the heavy metals (Mn, Pb, Cd, and Cr) in the facing bricks were identified. The obtained results show that facing bricks with dredged sediments and 5% paper mill residue fired at 700 ^{o}C exhibited beneficial characteristics. Therefore, dredged sediment and paper mill residue are suitable for use as primary raw materials in the production of facing bricks.

Keywords**:** dredged sediments; paper mill residues; facing bricks

Health Survey of Primary-School Children in the Vicinity of a Sanitary Landfill in Nonthaburi, Thailand

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Paper # No. III-10-O

Abstract

Recently, communities in the vicinity of a sanitary landfill in Nonthaburi have complained for bad landfill odor. This exposure to landfill odor and air pollutants may affect surrounding sensitive population like school children. In Thailand, there is no study on the excess risk of landfill-related symptoms in children. We then surveyed prevalence of the related symptoms among school children and investigated an association between the landfill-school distance and 8 adverse health effects. There were 2,362 students participating from a total population of 3,606 students (65.5%) of 12 kindergarten and primary schools. Participants were categorized into 3 landfill-school distances; Distance 1 (0-<4 km), Distance 2 (4-<7 km) as for exposed groups, and Distance 3 (7-<11 km) as for a reference group. A questionnaire asked their parents for odor exposure at school, children and family characteristics and children's recent related symptoms. Most children and family characteristics among Distances 1-3 were fairly similar thus to help control confounder effects. For odor exposure, they reported the odor exposure frequency as "sometimes" for 58%, 40%, and 29% in Distances 1-3 respectively. We found high prevalence for runny nose (82%), cough/sneeze (no fever) (78%), and headache (61%). Crude odds ratios as health risks were positively associated with all symptoms, were highest in Distance 1 and were decreasing over Distances 2 and 3 respectively. The risks in Distance-1 children were statistically significant (OR, 95% CI) in 3 symptoms, wheeze (1.278, 1.032-1.583), irritated eyes (1.296, 1.046-1.606), and fatigue (1.587, 1.282-1.965). For odor report, the risks were increased in all symptoms for those self-reporting odor exposure. With the odor exposure, all symptoms showed the statistically significant association except headache. They were runny nose (1.312, 1.056-1.631), wheeze (1.306, 1.106-1.542), cough (1.423, 1.165-1.737), vomit (1.202, 1.012,1.427), diarrhea (1.272, 1.012, 1.427), irritated eyes (1.357, 1.151-1.601) and fatigue (1.521, 1.289-1.796). These findings are consistent with other works reporting that students and community surrounding landfills had statistically significant excess risks. This work confirmed the landfill odor-symptom relationship. It also agreed the closer school was located to landfills, the greater health risk was. However, it lacked of quantitative monitoring data of fugitive landfill emission and did not adjust for other confounders.

Keywords: landfill; children health; landfill health effects; solid waste

Farmers' Intention and Decision to Adapt to Climate Change: A Case Study in the Yom and Nan Basins, Phichit Province of Thailand

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Paper # No. III-1-P

Abstract

Adaptation at farm level is an effective measure to cope with global climate change. The study aims to clarify farmers' intentions and decisions regarding global climate change adaptation. Results showed that farmers' perceptions were consistent with the weather data over a short period, reporting a rise in temperature and a greater decrease in precipitation. Agricultural experience, farm income, training, social capital, and effective climate adaptation communication were statistically significant in increasing the probability of farmers' adaptation. For farmers who do not perceive climate change but adapted nonetheless, social capital played a major factor, driving their belief in, and behavior to adaptation, of which the most important aspects were neighbors and peer groups. Farmers' intention to adapt was mostly affected by perceived behavioral control factors, followed by attitude and subjective norms. Therefore, successful policies to enhance farmers' perceptions and adaptive capacity can encourage both actual and intended adaptation farmers. Adaptation strategies require the participation of multiple players from all related sectors engaging with local communities and farmers.

***Keywords*:** climate change; adaptation; communication; logistic regression model; theory of planned behavior

Practical Global Policy and Environmental Dynamics: Case Study in Environmental Epidemiology

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Paper # No. IV-1-i

Abstract

London used to be famous for its fog due to coal burning in buildings and in each household. In December 1952, daily death of London rose sharply to the level several times higher than before for a few days. Shortly before the sudden increase of mortality, the level of black smoke increased sharply for few days but even after its decrease to the usual level, the high level of mortality remained for several weeks. Largest cause of the excess death during the period was respiratory diseases followed by cardiovascular ones.

Fifty years later, we conducted an epidemiological study in Bangkok where major source of air pollution was automobile exhaust. In our cross-sectional study, we examined the relationship between traffic-based air pollution and chronic, nonspecific respiratory symptoms among traffic policemen in Bangkok. A total of 1,603 policemen who lived and worked in areas that had 3 different levels of airborne particulates were evaluated. We used a modified standardized questionnaire to identify nonspecific respiratory disease (NSRD) in participants. The prevalence of NSRD in heavily polluted, moderately polluted, and suburban areas was 13.0%, 10.9%, and 9.4%, respectively. Among nonsmokers, the age-adjusted prevalence of NSRD in the heavily polluted areas was significantly higher than in the suburban control area (Tamura et al,). Using the hospital visit record, we also found a short-term association between increases in daily levels of PM_{10} and O_3 and the number of daily emergency hospital visits, especially among elderly, for cardiovascular diseases in central Bangkok (Buadong D et al,).

As demonstrated by these studies, air pollution is an actual threat to life and health of people. Ischemic heart disease and lower respiratory infection are the two largest causes of mortality in Thailand in 2015 and air pollution contributes nearly 5% of the death and disability there (http://www.healthdata.org/thailand). The six-city study in the United States demonstrated that improvement of air quality can improve life-expectancy of the community (Dockery et al,). For the last twenty years, particulate air pollution in Tokyo has steadily improved (Hara et al,) and the experience in Tokyo may provide ideas how to control the air pollution.

In conclusion, I would like to emphasize the importance of international collaboration to tackle the air pollution problems while maintaining economic activity.

A Comparison of Chronological Changes in PM_{10} Concentrations in Four Asian Mega-Cities

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Paper # No. IV-2-i

Abstract

The aim of this study was to compare the trends of PM concentrations in four Asian mega-cities and to investigate the factors affecting them. Given the lack of $PM_{2.5}$ data, we focused on the PM_{10} trends from 1995 to 2015 in the following four Asian mega-cities: Bangkok, which is home to the Bangkok Skytrain (a monorail) and subway system; Beijing, which is characterized by frequently high PM_{10} and $PM_{2.5}$ concentrations; Jakarta, where traffic jamsare serious; and Tokyo, which has fairly improved.

The annual average PM_{10} concentrations have generally decreased in the four Asian mega-cities since 1995. However, annual average PM_{10} concentrations increased by more than 20% between 2000 and 2001, and 2010 and 2011, in Bangkok; the same situation occurred between 2001 and 2002 in Jakarta. Annual average PM_{10} concentrations decreased by more than 20% in 1996–1997, 1998–1999, and 2000–2001 in Bangkok; by 17% in 2007–2008 in Beijing; by more than 20% in 1995–1996, 1999–2000, and 2013–2014 in Jakarta.

The numbers of registered vehicles have increased in Bangkok, Beijing, and Jakarta, though that has decreased in Tokyo. Negative correlations were observed between annual average PM_{10} concentration and the numbers of registered vehicles in Bangkok and Beijing. A weak positive correlation was observed in Jakarta.

Positive correlations were observed between the annual average PM_{10} concentration and economic growth rate in Beijing, and negative correlations were observed for these aspects for Bangkok and Jakarta.

Model of Sustainable Wellbeing Integrated with Environmental Education for Agriculturist

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Paper # No. IV-1-O

Abstract

This research was survey research. The objective of this study was to develop a causal relationship model of social justice, economic justice, and environmental education variables influencing sustainable wellbeing of agriculturist via inspiration of public mind. The questionnaire was used as a tool for data collection from population of 155,534 agriculturists in Maha Sarakham Province in Northeastern region of Thailand. The samples of 400 agriculturists were collected by using Multi-stage Random Sampling technique. Model verification was computerized with Structural Equation model (SEM) by considering on Chi-Square value differs from zero with no statistical significant at 0.05 level or Chi-Square/df value with lesser or equal to 5, RMSEA (Root Mean Square Error Approximation) value with lesser than 0.05, index level of model congruent value with GFI (Goodness of Fit Index) and AGFI (Adjust Goodness of Fit Index) between 0.90-1.00. The finding revealed that the structural model confirmatory factors of component analysis of Social Justice (SoJ), Economic Justice (EcJ), Environmental Education (EE) and Inspiration of Public Mind (PM) were able to elucidate the variation of endogenous latent variable of Sustainable Wellbeing (SW) with 95.00%. In addition, the exogenous variable of SoJ has the highest effect to PM with 0.51. The EE and EcJ were subsequent effect to PM with 0.34 and 0.30. Therefore, SoJ, EE and EcJ were able to clarify the variation of PM with 86.00%.

***Keywords*:** social justice; economic justice; environmental education; inspiration of public mind; sustainable wellbeing; agriculturist

Health Risk Assessment of PM_{10} and $PM_{2.5}$ in Chiang Mai, Thailand

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Paper # No. IV-2-O

Abstract

Human exposure to fine particulate matter with the aerodynamic diameter of less than 10 µm, (PM_{10}) and 2.5 µm ($PM_{2.5}$) are found to be associated with respiratory symptoms and diseases. The ultra-fine and fine particulates concentrations are increasing in urban areas. Chiang Mai a big city in north Thailand is also facing serious air pollution problems. The government designated the National Ambient Air Quality Standards (NAAQS) and implemented countermeasures for criteria air pollutants such as Total suspended particulate matters (TSP), PM_{10}, $PM_{2.5}$, sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2) and ground level ozone (O_3). In this work, daily ambient air particulate concentrations were analyzed and calculated as Hazard quotient (HQ) of PM_{10} and $PM_{2.5}$. HQ value with less than 1 is considered to be of minimal risk for adverse health effect arising from exposure. The higher HQ is from a value of 1 or > 1 indicated the potential of a risk from pollution exposure in the area, HQ in Mueang Chiang Mai district from January to May 2016 was higher than 1.

***Keywords*:** air pollution; health risk assessment; particulate matter; hazard quotient

Efficacy of Integrated Method between Gravid Aedes Trap (GAT) and Space Spray for Controlling Dengue Vectors in Bangkok

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Paper # No. IV-4-O

Abstract

Aedes Aegypti is the main vector of dengue viruses, and they are also competent vectors for several exotic pathogens such as Zika and Chikungunya viruses. As they are a growing public health concern, methods to control these mosquitoes need to be implemented to reduce their potential for disease transmission. There is a crucial need to evaluate methods as a part of an integrated mosquito control strategy in Thailand. This study is divided into two parts: 1) to study hot spot of dengue fever in the past five years at Pom Prap Sattru Phai district, Bangkok, Thailand and 2) to evaluate the effectiveness of dengue controlling method which space spray technique by Gravid *Aedes* Trap (GAT) in the focus areas. The efficacy of integrated method between GAT and Space Spray for controlling Dengue vector in Bangkok was studied. The 398 dengue cases data was collected for five years, from 2011 to 2015. Data were analyzed indicating the pattern of hotspot Dengue prevalence distribution by GIS –based maps. The 5 dengue cases were chosen to treat with integrated methods by space spray, larvicide method and Gravid *Aedes* Trap (GAT). These approaches may use for increasing effectiveness of integrated vector management (IVM) in the future.

***Keywords*:** dengue fever; GIS; gravid aedes trap (GAT)

Adverse Birth Outcomes among Infants Born to Women Living near a Sanitary Landfill Site in Nonthaburi, Thailand

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Paper # No. IV-7-O

Abstract

Nonthaburi province's population size has increased continuingly due to its rapid economic growth. An isolated area for its sanitary landfill formerly with limited residences has become crowded with new residences for past two decades. Therefore, its surrounding communities might be exposed to fugitive landfill pollutants, especially sensitive population like pregnant women. This landfill exposure may risk them for adverse birth outcomes. In Thailand, the knowledge about the relationship between adverse birth defects and living nearby a sanitary landfill was well limited. This work then determined prevalence of 5 adverse birth outcomes around a sanitary landfill of Nonthaburi and explored the risk of the outcomes related to living neighboring to the sanitary landfill site by applying a cross-sectional epidemiological study. The birth defects comprised of 5 adverse outcomes including preterm birth, intrauterine growth retardation (IUGR), stillbirths, low birth weight and very low birth weight. The subjects were all infants whose mothers had deliverance at the Sainoi hospital between 2009-2017. A number of 3,623 birth records were retrieved from the hospital and were coded as an exposed group (n = 2,107) and a reference group (n= 1,477). The exposed group was infants whose mother's landfill-residence distance was less than 9 kilometers. The reference group was infants whose mother's landfill-residence distance was equal or more than 9 - 40 kilometers. For the results, we noticed that characteristics of mother and infant (infant's sex, year of birth, maternal age, marital status, alcohol consumption, and smoking) between two groups were not different. This similarity between groups would help to control for confounding effects of such variables. The estimated prevalence was for IUGR (7.52 %), low birth weight (7.51%), preterm birth (1.05 %), very low birth weight (0.63 %), and stillbirth (0.26 %). Only the prevalence of preterm birth showed a statistically significant increase in the exposed infants (p-value < 0.05). For the association between the landfill-residence distance and adverse birth outcomes, the odd ratios (OR) results showed that 3 of 5 outcomes were positively associated with the sanitary landfill exposure. These were very low birth weight (OR and 95% CI: 1.61, 0.62 - 4.2), preterm birth (2.12, 1.03 - 4.35), and stillbirth (1.64, 0.42 - 6.34). Only the preterm birth outcome was statistically associated with the living in the vicinity of the sanitary landfill of mothers. The results were in agreement with works in other countries that the infants whose mother lived closer to the landfill site had a higher risk of the adverse birth outcomes. However, landfill monitoring data was not available and the analysis did not account for influence of any confounders or other factors that can affect the adverse birth outcomes.

***Keywords*:** landfill; adverse birth outcomes; cross-sectional study

Respiratory Hospitalizations of Children Living near a Sanitary Landfill in Nonthaburi, Thailand: a Cross Sectional Study

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Paper # No. IV-8-O

Abstract

Recently, a number of new communities surrounding a sanitary landfill in Nonthaburi province have increased from a high residence demand. Thus, sensitive population of children in those communities could be exposed to fugitive landfill contaminants. This landfill exposure may risk them for an excess risk of respiratory illness. In Thailand, there was a knowledge gap of the association between children's respiratory health effects and living nearby a sanitary landfill. This study aimed to survey prevalence of landfill-related respiratory disorders and to estimate the excess respiratory health risk in children living near the sanitary landfill site. We acquired hospital admission records of 6,097 children aged 0 - 14 years old admitted with infectious disease, respiratory disorders, digestive disorders at the Sainoi hospital from June 2008 - May 2017. The exposed participants were those living inside a radius of 10 km from the landfill center while the reference group lived outside it. The results showed that 3,605 participants lived in an exposed zone (59.13%) and 3,223 participants were admitted with respiratory illness (52.69%). Their characteristics (sex, age, admission season and family smoking) between exposed and reference groups were not quite different in terms of proportions. These undistinguishable characteristics between groups could alleviate confounding effects from such variables. The greater prevalence of all 6 respiratory outcomes was observed in the exposed group and 5 of them were statistically significant increased ($p > 0.05$). For the association between children's respiratory outcomes and living near the landfill, we found positive association in all six respiratory outcomes. Their crude odd ratios (OR) were for acute upper respiratory infections (OR=1.164, 95%CI: 1.038-1.305), acute respiratory infections (1.277, 1.152-1.415), pneumonia (1.186, 1.035-1.359), asthma (1.039, 0.826-1.307), acute bronchitis (1.203, 1.101: 1.444) and all respiratory symptoms (1.293, 95%CI: 1.167-1.432). All 5 respiratory outcomes considered as acute effects showed statistically and significantly increased risk except asthma considered as a chronic effect. The findings were consistent with other works confirming the closer living to the landfill site, the greater respiratory health risk in children. Nevertheless, quantitative landfill contaminant monitoring was not available and the analysis did not account for any other confounders or other pollutant sources that may cause adverse respiratory illness in children.

Keywords: landfill; respiratory symptom; respiratory hospitalization; children

The Model of Khok Hin Lad Forest Conservation Community School, Mueng, Mahasarakham, Thailand

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Paper # No. IV-1-P

Abstract

Community forest is important for community livelihoods and environmental quality since it is the natural and environmental resources. In order to maintain the balance of the community forest, learning and maintaining the community forest are required. Therefore, the researchers were interested in creating the learning process by developing the model of Khok Hin Lad forest conservation community school, Mueng district, Mahasarakham province, Thailand with the objective to create the model of participatory learning of Khok Hin Lad forest conservation community school for contributing to sustainable forest management. The study areas were nine community forests of Khok Hin Lad forest conservation community.It was a 4-month learning process, which was administered only on Saturdays. The instructors were the community forest leaders. The students were from the Faculty of Environment and Resource Studies, Mahasarakham University. It consisted of 9 learning units, including history of Khok Hin Lad forest, Khok Hin Lad area, forest, wildlife, mushrooms, forest ecology, ecological culture, participation in forest conservation and the map of Khok Hin Lad community forest. The study indicated that the model of Khok Hin Lad forest conservation community school can be used to create a real learning process in the area which resulted in participatory learning process. After attending the class, the students had more knowledge, awareness and participation than before attending the class.

Keywords**:** Khok Hin Lad forest conservation community school; knowledge; awareness; participation

Teaching Environmental Science to Promote Thai Qualifications Framework for Higher Education

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Paper # No. IV-12-P

Abstract

Environmental science is an environmental knowledge that integrates knowledge in various sciences disciplines associated with environment such as ecosystems, biodiversity, pollution and environmental ethics in order to be used in the prevention, remediation and management of natural resources To apply the knowledge in the occupation under professional ethics as will be rate in both knowledge conserving and sustainable natural resources and the environment. Therefore, the researchers were interested in studying the teaching of environmental science based on Thai Qualifications Framework for Higher Education to compare students' learning achievement in environmental science course and to study the standard assessment of learning outcomes of environmental science course. The samples were 117 first year undergraduate students studying in environmental education, Faculty of Environment and Resource Studies, Mahasarakham University, academic year 2016. The instructional material of environmental science course and the test of environmental science course, the attitude measurement on environmental science, the environmental ethics test and the standard assessment form of environmental science course were the research instruments. The study indicated that after the teaching and learning of Environmental Science Course, the knowledge about the environment, the attitude towards environmental science and the environmental ethics of the students were higher than those of before learning. According to the standard assessment of learning outcomes according to Thai Qualifications Framework for Higher Education; the overall environmental science course of undergraduate students was in a high level.

***Keywords*:** teaching; environmental science; knowledge; attitude; environmental ethics, learning standards based on Thai Qualifications Framework for Higher Education

Spatial and Vertical Distributions of Particulate Heavy Metals and Their Sedimentations in the Bangpakong River Estuarine Ecosystem

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Paper # No. IV-13-P

Abstract

The Bangpakong River estuarine ecosystem (BREE) provides many of the ecosystem services such as nursery ground for many species of birds, fish, and other animals. Besides being natural habitats, anthropogenic activities along the rivers are diverse entailing urban community, transportation, tourism, fishery, aquaculture, and industry. In the last decades, adverse impacts of water pollution in Bangpakong River have been raised to a regional environmental concern as a result of human intervention. Therefore, five intertidal sites along the BREE were examined for concentrations of heavy metals including Ag, Cd, Co, Cr, Cu, Fe, Mn, Ni Pb, and Zn in both particulate matter of water and sediment profiles, in order to evaluate the spatial and vertical distributions of suspended particulate matter and chemical composition of sediment (exchangeable, carbonate bound, Fe-Mn oxides bound, organic matter/sulfide bound, and residual fractions), which were analyzed the ecological risk. Moreover, sedimentation of heavy metals was experimented in the river, estuary and sea zone, where were different the organic matter deposition.

The result showed that the distribution of particulate Ag (1.881 µg/L), Cr (12.64 µg/L), Fe (2.925 mg/L), Mn (48.20 µg/L) and Zn (4.823 mg/L) contamination was highest in Bangpakong River. While, the distribution of most heavy metals consist of Cr (52.49 µg/g), Cu (19.27 µg/g), Fe (27.28 mg/g), Ni (19.47 µg/g), Pb (14.55 µg/g) and Zn (62.44 µg/g) in surface sediment was highest at Bangpakong River Estuary and the distribution of Ag (2.409 µg/g) and Co (16.58 µg/g) in surface sediment was highest at Bangpakong River. In addition to ecological risk, the result showed that Ag (54%) and Mn (59%) posed a very high risk to ecosystem. Moreover, Mn in surface sediment was higher than SEL values of National Oceanic and Atmospheric Administration. Besides, the heavy metals sedimentation rate in the inner Gulf of Thailand was higher than Estuary. Furthermore, accumulations of Mn due to river runoff in the Bangpakong River Estuarine Ecosystem were related to human activities.

***Keywords*:** heavy metals; particulate matter; sedimentation; sediment; ecological risk assessment; the Bangpakong River estuarine ecosystem

Bioaccumulation and Health Risk Assessment of Heavy Metals in the Bangpakong River Estuarine Ecosystem

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Paper # No. IV-15-P

Abstract

Anthropogenic pollutants have contaminated many ecosystems such as sea, estuaries, and rivers. Heavy metals are now recognized to be among the most relevant contaminants in the marine environment and their concentrations are elevating in some coastal waters. Since aquatic organisms living in polluted ecosystems often accumulate metals into their tissues, it has been suggested that these organisms can be used as biomonitors to indicate the bioavailability of contaminants and the degree of pollution. The Bangpakong River estuarine ecosystem (BREE), is a serious one of heavy metal contaminations due to industries, agriculture and urban wastewaters discharges. Therefore, the three main objectives of this study were: (1) to analyze heavy metals and their concentrations of benthic and pelagic organisms from BREE; (2) to evaluate the bioconcentration and bioaccumulation factors of BREE and (3) to assess the preliminary health risk for the consumers due to seafood consumption from the markets around BREE. Samples used in this study were collected from BREE. In addition, the seafood samples were collected from commercial markets, which are located around the BREE to evaluate health risk assessment.

The results showed that Cd accumulation in natural organisms in order of *Tegillarca granosa*, *Parapenaeopsis hardwickii* and *Paphia undulate* was 16.25, 2.106 and 1.152 mg/kg. Cu accumulations of *Parapenaeopsis hardwickii*, *Pleuronectiformes* and *Gobiidae* was 27.21, 21.80 and 20.83 mg/kg. Pb accumulations of *Parapenaeopsis hardwickii*, *Teuthida*, *Gobiidae*, *Sepiida*, and *Leiognathida* was 6.879, 4.051, 2.010, 1.528 and1.034 mg/kg. While, Zn accumulation of *Asteroidea* was 192.5 mg/kg. Maximum safe consumption of seafood from market around BREE was 230.6-4,020 g wet wt/day for Cd and 379.0-3,985 g wet wt/day for Pb. According to the maximum safe consumption of Cd, *T. granosa* and *P. viridis* were affected to health of consumer. In addition, *Terapon, Metapenaeus intermedius*, *Rastrelliger* and *P. monodon* and *S. lessoniana* were species that affected to health of consumer.

Keywords: heavy metals; bioaccumulation; health risk assessment; the Bangpakong River estuarine ecosystem

Legal Compliance of Health Spa Business in Ubon – Ratchathani Province

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Paper # No. IV-16-P

Abstract

The purpose of this research was to study the level of legal compliance and knowledge of health spa business, the suggestions of entrepreneurs and service providers of the health spa in Ubon Ratchathani province. Data were collected by interviewing and analyzing with descriptive statistic, distribution frequency and percentage. Content validity test was applied, consistency index of part 1, entrepreneurs questionnaire was 0.96 and part 2 service providers questionnaire, was 0.98. The results showed that all entrepreneurs able to follow up the health spa law with high level and knowledge about business in health spa are in high level. For the service providers of the health spa able to follow up the health spa law with high level (51.60 %). All of the service providers have knowledge about service and safety in health spa with high level. The health spa standard in Ubonratchathani province are suggested that entrepreneurs should participant in period of related regulation setting for the benefit in both entrepreneurs and health spa standard supervision officers. The regulations should not conflict with services and customer. The registration process of health spa should be clarify.

Keywords**:** legal compliance; health spa business

The Model of Solid Waste Management in Mahasarakham Province

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Paper # No. IV-18-P

Abstract

This research were to study solid waste management in Mahasarakham Province and to study the solid waste management model in Mahasarakham province. The research area was made up of 13 districts in Mahasarakham province. The amount of solid waste in Mahasarakham province was found at 379,9 tons per day. There were 28 waste disposal sites in Mahasarakham. Over the past five years, 693,542.5 tons of solid waste has been accumulated. The used budget for garbage collection totals 34,262,280 Baht per year. There were 39 solid waste management personnel and there are 111 garbage collection trucks. The frequency of solid waste collection was about 115 times per day collected from Monday through Friday. The solid waste management of Mahasarakham was divided into centers: cluster 1: a district waste energy plant (mueng districts), cluster 2 (Chiang Yuen districts), cluster 3(Borabuesubdistrict districts), cluster 4 (Phayakkhaphum districts) and cluster 5 (WapiPathum districts) were a landfill site for waste disposal to be transported to the waste electrical power plant.

***Keywords*:** solid waste management in Mahasarakham province

Adoption of solar energy innovations for social change: A case study of Chinese society

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Paper # No. IV-19-P

Abstract

The diffusion of solar energy innovations enabling global warming deceleration and people's quality of life improvement needs more investigation to promote more effective diffusion and adoption. This study aims to explore the processes and drivers of, and the barriers to, rural people's adoption of solar water heater (SWH) including analyze and synthesize the diffusion and adoption of practical solar energy innovations. Based on the integration of diffusion of innovations theory, the theory of reasoned action, and the theory of acceptance model, the factors of SWH adoption were established. Binary logistics regression was used to analyze the factors influencing rural people's decision to adopt SWH. The key drivers are social influence, physical need and innovation characteristics, respectively. To achieve widespread effective innovations from policy level to rural communities, a two-step flow of diffusion from the government to salespersons and then to rural communities, especially earlier adopters, is strongly recommended.

***Keywords*:** solar energy; solar water heater; diffusion; adoption; social change; China

Environmental Health Impact Assessment of Community Solid Waste Management Project in Ban Donyom, Thakhonyang Sub-district, Kantharawichai, Mahasarakham, Thailand

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Paper # No. IV-20-P

Abstract

Waste is an environmental increase severe problem cause from population increase, development of economic social and technology. It affected quality of life and contaminated environment causing environmental pollution. Researcher was interested to study environmental health impact assessment of community solid waste management project in Ban Donyom, Thakhonyang sub-district, Kantharawichai district, Mahasarakham province. The results were dividing in 4 directions as follows: 1) environmental impact assessment as physical environment resources assessed on states of terrain and soil resources, meteorology and air quality, hydrology of surface water and groundwater, aquatic ecology, terrestrial ecology, land use, and socio-economic, concluded that the project does not impact both in construction and operation phase, 2) community feedback to the project, mostly knew about the project and relatively confident in project management, and people in community agreed and appropriated for construction of waste management project. 3) Health impact assessment in constructional phase and operational phase as body, mental, intelligence and social. The impact was low level and 4) preventive and corrective measures for environmental quality monitoring were implementing to prevent and correct measures strictly on environmental quality monitoring and used as a guide to direct supervision, monitoring and control of department, people and related organizations.

Keywords**:** environmental health impact assessment; community waste management project

A Powerful Research Tool for Screening and Development of Solid-state Catalysts Building up the Environment Harmless Chemical Technologies

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Paper # No. V-1-i

Abstract

Environmentally harmless technologies are essential for the global environmental protection. However, most of chemical processes in chemical industries still remain low efficient and environmentally harmless; where E-factor (kg waste/kg product) of small chemical processes remains generally 5 – 100. In addition, conventional chemical processes involve the usage of organic solvents and toxic materials so that these processes would be replaced with environment friendly materials. To improve or replace such inefficient and harmless processes with more efficient and environmentally friendly processes, the development of recyclable and environmentally friendly solid-phase catalysts without using organic solvents is a key approach. In the present study, the potential of hydrothermal flow reactors, which would be useful for development of solid-state catalysts in hydrothermal conditions, will be described.

***Keywords*:** research tool; solid-state catalyst; liquid-solid phase reaction; classical inefficient industrial chemical processes; high temperature; hydrothermal reaction

The Results of Public Participation Process for the Compensation of the Socio and Environmental Impact of a Crude Oil Leak Samet Island Rayong Province

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Paper # No. V-1-O

Abstract

This research investigate the results of the implementation of the public participation process that was run for compensation of the socio and environmental impacts of a crude oil leak in the Samet Island Rayong Province. The area, a tourist area of the Samet Island Rayong Province has been divided over a number of sub-areas that all have been separately assessed in July 2013. The areas include: Samet Island community, Harbor village, Ruby Bay, Nual Bay, Custard Apple Bay, Bamboo Bay, Phrow Bay, Crescent Bay and Crystal sand Bay. The result of study show that public participation included: providing consultation, involvement, collaboration were implemented in Samet Island community mostly. This was calculated as percentage over the sub items as 72.22 %, 68.89 %, 72.22 % and 74.44 %. Except for the topic of empowerment, which was implemented in Custard Apple Bay only and calculated as 71.43 %. In all arrears where implemented the public topic were implemented the level of participation varied between moderate (60.00 – 69.99 %) to well (from 70 - 79.99 %). However, all forms of participation that were assessed in Phrow Bay reach the level pass-moderate. The main conclusion of this study is that sectors in developing project organization that manage environment should improve public participation process. This research may be as the tool of management to assess public participation in environmental tasks by more improving and developing.

Keywords**:** compensation of environmental impact; public participation; Samet Island crude oil leak

Non-Formal Leaders as Intermediates for the Creation of Environmentally Aware Behavior with Regard to Arsenic Contamination of Surface Water from the Klongkram Watershed, Tha Utae Sub-District, Kanchanadit District, Surat Thani Province

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Paper # No. V-2-O

Abstract

The King's Royally Initiated Laem Phak Bia Environmental Research and Development Project, Chaipatthana Foundation and environmental faculty of Kasetsart University Bangkhen campus implemented a study on the environmental impact of a disaster in 2015. This assessment was conducted at the Klongkrarm watershed in the Tha Utae sub-district of Kanchanadit district in Surat Thani province. During the assessment there was discovered the landslide area contain arsenic contamination in the surface water. As a result this research focused on the possibility of setting up an environmental education program for knowledge transfer on the properties of arsenic by addressing non-formal leaders of the local population. This knowledge transfer about acknowledgement, understanding and applying measures with regard to the arsenic contamination is separated into 3 parts: (1) the knowledge about the arsenic compounds and its toxicity (2) the point sources and (3) the removal of arsenic. The assessment in the pretest sampling showed that 47.15 percent of the interviewees know arsenic. 50.50 percent of them understanding the problems of the compound and only 49.78 percent can apply knowledge to deal with the compound. And the assessment in the posttest 75.57 percent of the interviewees knows arsenic. 78.97 percent of them understanding the problems of the compound and 77.05 percent can apply knowledge to deal with the compound. From the study research showed that after the target group received the information about arsenic contamination in surface water by the lecturer in training program they are more increased knowledge, understanding and are able to apply measures of arsenic contamination respective. The sampling group for this research included 11 volunteers.

Keywords: non-formal leaders; environmental behavior; arsenic contamination

Public Participation in Environmental Impact Assessment of Real Estate Development Projects in Nakhon Ratchasima, Thailand

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Paper # No. V-3-O

Abstract

This study aims at investigating the public participation (PP) process in Environmental Impact Assessment (EIA) of real estate development projects in Nakhon Ratchasima, Thailand. The investigation was conducted based on key aspects of PP in EIA as suggested by ONEP (B.E.2549) and Nadeem and Fischer (2011). Public participation legal requirements, stakeholders, information quality, timing & venues of PP, and public consultation methods are the focus when assessing how public participation in EIA was conducted according to 21 approved EIA reports of real estate development projects (between B.E. 2537-2558), prior to semi-structured and in-depth interviews related to cases of focused project type (condominium projects). The findings suggest that legal enforcement of such regulations are subject to area and community context. Meanwhile, paying attention to delivering project information to stakeholders is key which could help ensure that most relevant stakeholders can take part in the EIA process as well as mitigating conflicts among them.

***Keywords*:** public participation; environmental impact assessment; real estate development project

The Impact of Land Use Land Cover Change on Ecosystem Services in the Border Zone of Kasungu National Park, Malawi

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Paper # No. V-4-O

Abstract

The ecosystems are affected by land use land cover changes that require understanding of their impacts for the sustainable management of ecosystems to continue benefiting from their services. The increase in demand for more agricultural land, new settlements and high dependence on fuel wood exerts pressure to adjacent protected areas. The pressure is evidenced by illegal activities that include illegal tree cutting, encroachment, poaching and fence vandalism in protected areas such as national parks as well as forest reserves. This study was conducted in the border zone of Kasungu National Park (KNP) to assess the impacts of the land use land cover changes on ecosystem services. Valuation of ecosystem services has been employed using Constanza model reviewed in 2011. The model uses the Value Coefficients for land class and its coverage to estimate the value of ecosystem services. Remote sensing technique was employed to analyze changes for the period of 20 years from 1995 to 2015 using supervised classification. The results show the decline of ecosystem services from $367m in 1995 to $321m, in 2015, representing an average rate of $2.3 million per year. The largest loss was between 1995 and 2005 greatly contributed by loss of forestry resources at a rate of $8.7 million per year. The results of the study will be useful in raising awareness in KNP border zone and providing information for decision making on land use land cover.

Keywords**:** ecosystem services; land use land cover; remote sensing; supervised classification; community based natural resources management; environmental degradation

Effects of ZnO Nanoparticle on Plant Growth, Plant Stress, Zn Bioaccumulation in Water Hyacinth (*Eichhornia Crassipes*)

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Paper # No. V-5-O

Abstract

The efficiency of water hyacinth (*Eichhornia crassipes*) to accumulate zinc (in any form) from zinc oxide nanoparticles (ZnO NPs) was investigated. Plants were grown hydroponically for 15 d in half-strength Hoagland's No. 2 solution with ZnO NPs at a concentration of 0, 3.5, 5 and 7.5 mg/L. The concentration of total Zn in the roots, stems and leaves was then determined by inductively coupled plasma mass spectrometry, while the oxidative stress and antioxidant enzyme activity of the plants were examined in terms of the leaf hydrogen peroxide (H_2O_2) level and catalase activity, respectively. By dry weight (DW), the relative growth rate (RGR_{DW}) of the roots was not significantly different in all treatments. However, while the RGR_{DW} of the stems and leaves were much lower than the roots, when grown in the presence of 3.5 mg/L ZnO NPs the stem and leaf RGR_{DW} were significantly greater than in 5 and 7.5 mg/L ZnO NPs. The levels of H_2O_2 and catalase activity in leaves of *E. crassipes* grown without ZnO NPs did not significantly differ over the 15-d culture period, but significantly increased in the presence of 3.5 mg/L ZnO NPs over the 15-d period. These plants could uptake high levels of Zn, with maximum Zn concentrations in the roots, stems and leaves after 15 d of culture with 7.5 mg/L ZnO NPs of 945.83 ± 73.69, 129.11 ± 5.93 and 61.44 ± 3.13 mg/kg dry weight, respectively. Thus, *E. crassipes* has potential to be applied for phytoremediation of low concentrations of ZnO NPs from waste water or other solutions.

***Keywords*:** ZnO nanoparticles; bioaccumulation; catalase activity; *Eichhornia crassipes*

Natural Radioactivity in Groundwater in Phra Nakhon Si Ayutthaya Province

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Paper # No. V-6-O

Abstract

This research work aims to study the specific activity of natural radioactivity in groundwater samples taken in the area of Phra Nakhon Si Ayutthaya Province, Thailand. Totally, sixty groundwater wells located in eight districts were monitored and determined for radionuclides ^{226}Ra, ^{232}Th and ^{40}K using Hyper Pure Germanium (HPGe) gamma ray spectrometry and gross alpha/beta using Canberra Tennelec Series 5 glass flow proportional counter. Most of studied wells serve for consumption purpose and some other for agricultural purpose. The results showed that the activity concentrations of the gross alpha/beta were 0.01 ± 0.007 and 0.15 ± 0.02 Bq/L and the specific activity values were averagely 0.77±0.13, 1.03 ± 0.19 and 15.56 ± 1.28 Bq/L for ^{226}Ra, ^{232}Th and ^{40}K, respectively. The gross alpha beta and specific activity of ^{226}Ra, ^{232}Th and ^{40}K found in these samples exhibited quite low concentration in comparison to the recommended reference level for human consumption reported by World Health Organization (WHO).

Keywords**:** natural radioactivity; groundwater; gamma ray spectrometry; Phra Nakhon Si Ayutthaya

An Application of Geographic Information Systems for Wastewater Management Based on Land Use Characteristic in Chonburi Province

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Paper # No. V-7-O

Abstract

This paper aims to identify source of wastewater in residential area of Chonburi municipality and tourism area in Pattaya city. The steps taken into this study include BOD, structure of sewage network, wastewater treatment plant, outflow pipes, land use and then we integrated all of those data by GIS. BOD values of the wastewater from municipalities were 19 - 60 mg/l and of Pattaya city was 18 mg/l.

According to land use classification, it clearly showed that human activities were different between the two areas and wastewater quality in Pattaya city was better than that of Chonburi municipality. It was likely due to untreated wastewater in Chonburi municipality, had poor design of sewage network which were not covered the whole area yet. Expansion of the sewage network in each municipality is needed to receive wastewater that has increased with urban sprawls. Improvements of wastewater network and water quality will help us to access effective wastewater management in these areas.

***Keywords*:** GIS; wastewater management; land use; Chonburi Province

Environmental Health Impact Assessment and Its Defects in Thailand

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Paper # No. V-8-O

Abstract

Environmental health impact assessment (EHIA) has been legally implemented in Thailand since 2010 as mentioned by section 67 of Thailand's constitution 2007 stipulating that any project which may seriously affect to the community in quality of the environment, natural resources, and health required to be given opinions by the independent commission on environment and health (ICEH). There are currently 12 types of projects requiring EHIA which 26 projects were already performed. However, 50 % of those were condemnable whereas the rest were conditional approval due to no alternative choices, lack of good practices and governance, poor assessments in environmental hazardous and health impacts as well as inappropriate public participation. This paper identifies defects of EHIA in order to develop the quality of EHIA in Thailand as well as enhance trust among all stakeholders of the society.

***Keywords*:** EHIA; public participation; environmental impact assessment

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