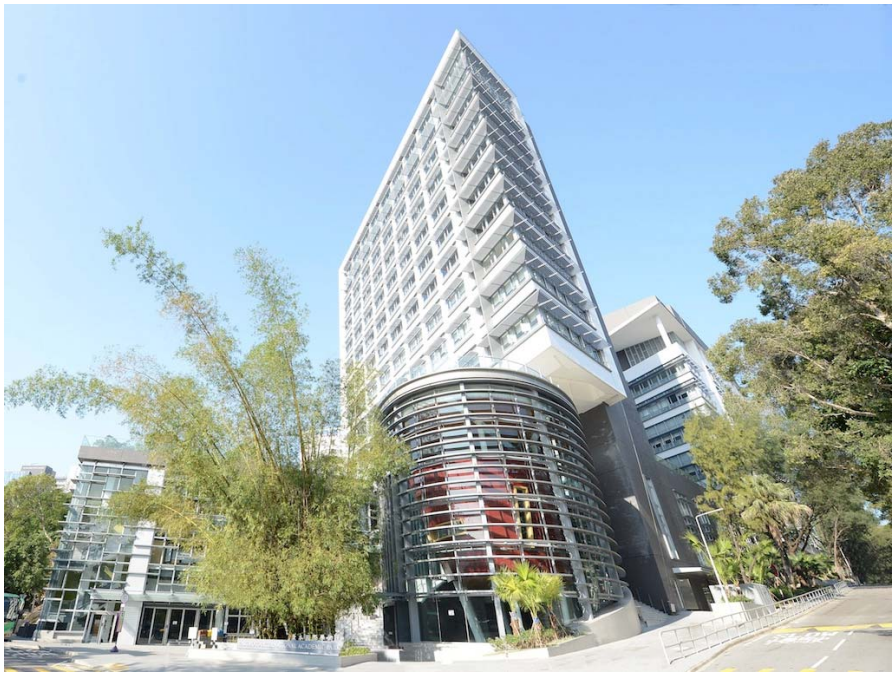
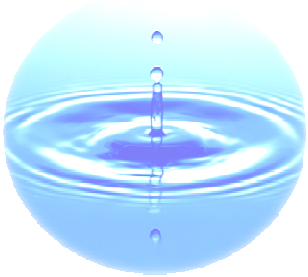
THE CHINESE UNIVERSITY OF HONG KONG
Environmental Science Programme
School of Life Sciences

20th Anniversary Workshop on: "Environmental Science and Technology for Sustainable Development"



Date: 25 January 2014 (Saturday)
Time: 9:00 am to 6:00 pm
Venue: LT5, Yasumoto International Academic Park, CUHK, Sha Tin



Programme

Time	Event/ Seminar	Abstract
9:00 am	Registration	
9:15 am	Opening Address by Prof. T Fung, Associate Pro-Vice-Chancellor, CUHK	
9:30 am	Guest Speech by Ms. Christine Loh, Under Secretary of the Environment, HKSAR Government	
9:45 am	Photo session	
10:00 am	Sustainable Management of Water Resources and Drinking Water Quality (Prof. KC Ho, OUHK)	Page 1
10:30 am	Magnetic Nanoparticles for Metal Removal from Industrial Wastewater (Prof. Irene Lo, HKUST)	Page 2
11:00 am	Tea break and poster session	Page 11-32
11:30 am	Advances in visible-light-driven photocatalytic bacterial inactivation (Prof. PK Wong, CUHK)	Page 3
12:00 pm	Endocrine Disrupting Chemicals, the Exposure and Their Multiple Effects on Reproductive functions (Prof. Chris KC Wong, HKBU)	Page 4
12:30 pm	Field-based species sensitivity distribution and community sensitivity distribution as alternative ways for deriving sediment quality guidelines (SQGs) and field validation of current SQGs derived from laboratory based approaches (Prof. Kenny MY Leung, HKU)	Page 5
1:00 pm	Lunch	
2:00 pm	Poster session	Page 11-32
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3:00 pm	Virtual Geographic Environment (VGE) system as a platform for environmental studies (Prof. H Lin, CUHK)	Page 7
3:30 pm	The Transition Fuel to Renewable Energies (Prof. KL Wong, CUHK)	Page 8
4:00 pm	Tea break and Visit to HKJC Museum of Climate Change	
4:45 pm	Linking the environment to health: examples in air pollution (Prof. TS Yu, CUHK)	Page 9
5:15 pm	Recent developments on climate change research (Prof. Gabriel Lau, CUHK)	Page 10
5:45 pm	Closing ceremony and souvenir presentations	

Sustainable Management of Water Resources and Drinking Water Quality

HO Kin-chung, BBS
Ng Chun Man Professor in Environmental Science & Conservation, and
Dean, School of Science & Technology,
The Open University of Hong Kong

Abstract
While the Pearl River Delta (PRD) region is rich of water resources taking into account of annual rainfall of 2,000 mm and the huge amount of reservoirs in the various stream and the tributaries of Pearl River, the situation of water supplies is complicated by various engineering constraints, social and environmental factors and political considerations. For example, water consumption in the region rose from 8.5 billion M^3 in 1980 to ~28 billion M^3 per year in 2013 due to increased human population and economic activities. While the potential water resource for PRD is estimated to be 6,341 M^3 per capita per year, in different locations of the region averaged rate of water consumption varies from 0.07 to 0.37 M^3 per head per day. Nowadays, many places of the Guangdong Province are being headache of supplying sufficient amount of tap water up to the WHO standards. However, on the basis of priority water-supply agreements with the Guangdong Province, Hong Kong and Macau are guaranteed for importing water from the major tributaries of Pearl River for support of their metropolitan life. For example, ~ 80 per cent of Hong Kong's potable water supply is imported from Dongjiang (The East River). Undoubtedly, the present situations have restricted incentives of water saving and development of a total water management plan. Facing the challenges ahead, it is necessary to implement practical Total Water Management (TWM) plans as well as to establish effective technological, economic, political and managerial mechanisms for sharing of water resources in the near future. This presentation discusses the technological means, environmental considerations and public administrative approaches in effective management of water resources in the region, from source to tap.

Keywords: Pearl River Delta, water resources, drinking water quality

Magnetic Nanoparticles for Metal Removal from Industrial Wastewater

Irene M. C. LO

Professor of Civil and Environmental Engineering
The Hong Kong University of Science and Technology

Abstract

Nanoparticles are attractive to many researchers because they are effective for metal removal due to their high surface area to volume ratio and greater number of reactive sites. Magnetic nanoparticles (MNPs) are the advanced development of nanoparticles because of its added-value of magnetic property, which enhances their wide-ranging applications of environmental remediation. Sol–gel and coprecipitation methods are the two common methods for synthesizing iron-based MNPs (such as γ-Fe_2O_3, $MnFe_2O_4$, metal-doped γ-Fe_2O_3 etc.). The preparation of iron-based MNPs is safe, simple, and inexpensive. The magnetic nanoparticles can be characterized using X-ray diffractometer (XRD) for crystal identification, transmission electron microscopy (TEM) for size and morphology investigation, BET analyzer for surface area measurement, and vibrating sample magnetometer (VSM) for magnetic property and behavior analysis.

The application of MNPs for the removal of Cr(VI) from electroplating wastewater has also been demonstrated. After wastewater treatment, the recovery of MNPs by the magnetic separation technique makes its potential to achieve complex environmental separations. Apparently, the magnetic nanoparticles possess the advantages of large surface area, high number of surface active sites, and high magnetic properties, which lead to high adsorption efficiency, high removal rate of contaminants, and easy and rapid separation of adsorbent from solution via magnetic field. However, on the subject of the recovery and regeneration of spent nanoparticles, little field information is available because of their difficulties of applying magnetic field in a real application. The efficiency of magnetic separation is influenced by the size of nanoparticles and the magnetic force, and thus a trade-off between the particle size and the applied magnetic force should be of consideration with respect to their technical feasibility. In this presentation, the focus would be on the environmental application of MNPs, their effectiveness and removal mechanisms, the challenges being faced for industrial applications, potential solutions for solving the technical problems as well as future development of the MNPs.

Keywords: Adsorbents; electroplating wastewater; nanoparticles; magnetic separation; andmetals removal

Advances in visible-light-driven photocatalytic bacterial inactivation

Po Keung WONG

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The Chinese University of Hong Kong

Abstract

Photocatalysis has been accepted as a promising alternative for microbial disinfection. In order to develop it to be an efficient and practical method, many studies have been conducted to further improve the treatment efficiency and applicability of photocatalytic disinfection. In this presentation, I would like to briefly introduce our projects on some new and interesting aspects in visible-light-driven (VLD) photocatalytic bacterial inactivation. They are (1) Application of a simple "partition system" and addition of various scavengers: (a) to identify the major reactive charged (e.g. e^- and h^+) and oxidative (e.g. $\bullet O_2^-$, $\bullet$OH and H_2O_2) species in VLD photocatalytic bacterial disinfection, and (b) to prove that the direct contact between some VLD photocatalysts and bacterial cells is not required for efficient inactivation; (2) Selection and characterization of naturally-occurring photocatalysts such as natural sphalerite to provide more economic and ample supply of VLD photocatalyst for large-scale photocatalytic bacterial disinfection; and (3) Providing experimental evidences, in the first time, to confirm the photogenerated e^- directly inactivate bacterial cell.

Endocrine Disrupting Chemicals, the Exposure and Their Multiple Effects on Reproductive functions

Chris KC WONG
Biology Department,
Croucher Institute for Environmental Sciences,
Hong Kong Baptist University

Abstract

In the past century the relentless advance of industrialization and technology and the consequent rapid growth of human populations have impacted on the environment in a way that is unprecedented in human history. An enormous number of synthetic chemicals with diverse structural features have been produced for industrial, medical and domestic purposes. These chemical substances, originally thought to have little or no biological toxicity, are widely used in our daily lives and are present in foods. It was not until the first World Wildlife Federation Wingspread Conference held in 1994 were concerns about the endocrine disrupting effects of these chemicals articulated. Since then, considerable numbers of studies have been conducted to reveal the health effects of endocrine disrupting chemicals (EDCs). The potential hazardous effects of EDCs on human health and ecological well-being are one of the global concerns that affect the health and propagation of human beings. Considerable amount of studies indicated that endocrine disruptions are directly linked to "the developmental basis of adult disease", highlighting the significant effects of ED exposure to a developing organism, leading to the propensity of an individual to develop a disease or dysfunction in later life. In this talk we will provide environmental and experimental data to associate EDC exposure with reproductive disorders, in particular on the male system. The possible effects on hypothalamus-pituitary-gonadal axis, testicular signaling and steroidogenesis will be discussed.

Field-based species sensitivity distribution and community sensitivity distribution as alternative ways for deriving sediment quality guidelines (SQGs) and field validation of current SQGs derived from laboratory based approaches

Kenneth Mei Yee LEUNG
The Swire Institute of Marine Science and School of Biological Sciences,
The University of Hong Kong

Abstract
The determination of predicted no-effect concentrations (PNECs) and sediment quality guidelines (SQGs) of toxic chemicals in marine sediment is very crucial in ecological risk assessment, sediment quality management (e.g. mud disposal in the sea) and environmental remediation (e.g. dredging of contaminated mud). However, current methods of deriving sediment PNECs are primarily based on laboratory ecotoxicity bioassays that are often lack of ecological realism. To tackle this issue, we have developed two novel alternative approaches to scientifically derive site-specific SQGs by utilizing field data of benthic communities and contaminant loadings concurrently measured in sediment samples collected from the site of concern. In this talk, I will first describe the principle of such field-based approaches. Secondly, I will introduce the field-based species sensitivity distributions (f-SSDs) approach, which is based on the relationship between species abundance and contaminant level. Thirdly, I will illustrate the community sensitivity distributions (CSDs) approach which is founded on the relationship between species richness and contaminant level, and makes use of Empirical Bayes methods. Norwegian continental shelf and the marine environment of Hong Kong will be taken as examples. Overall, the field-data-derived SQGs appear to be more environmentally relevant and ecologically realistic. The f-SSDs and CSDs can be directly used as benchmarks for probabilistic risk assessment. The field-data-derived SQGs can be employed as site-specific guidelines, and used to validate the current SQGs derived from laboratory ecotoxicity data. Finally, the limitation and on-going international development of these field-based approaches will also be highlighted.

Biosphere-atmosphere interactions: prioritizing strategies for air quality, agriculture and public health under global climate change

Amos P. K. TAI
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The Chinese University of Hong Kong

Abstract

Global environmental change affects many aspects of our everyday life including the air we breathe and the food we eat. For instance, climate change influences human health by modifying the frequencies of air pollution episodes and heat waves. Climate change and air pollution together substantially impact agricultural productivity, thus threatening global food security. Anthropogenic changes in ecosystems in turn affect both air quality and climate. A realistic assessment of these impacts is crucial for sustainable planning, but it also requires a better understanding of the complex interactions between climate, atmospheric chemistry, and the biosphere. In this talk, we will show how a combination of statistical and process-based computer models enables us to examine various facets of biosphere-atmosphere interactions, allowing us to predict the individual and combined effects of different environmental changes and thus inform policy formulation. Particular attention will be paid to how an integrated system approach allows us to prioritize strategies concerning air pollution control, food security, land use, and climate change management.

Virtual Geographic Environments (VGE) as a platform of regional environmental studies

Hui LIN
The Chinese University of Hong Kong

Abstract
For regional environmental studies, dynamic monitoring and modeling the changing environment are two key issues. To facilitate an effective communication and knowledge exchange among experts and decision makers, we may need to develop a platform which can help to accommodate the data from sensor network and the geo-process models from experts. Evolved from maps and digital map database (GIS), virtual Geographic Environmental (VGE) had become a new generation of environmental studies.

VGE is proposed as a new generation of geographic analysis tool to contribute to human understanding of the geographic world and assist in solving geographic problems at a deeper level. The development of VGEs is focused on meeting the three scientific requirements of Geographic Information Science (GIScience) – multi-dimensional visualization, dynamic phenomenon simulation, and public participation. This talk will introduce the conceptual framework and the components of a complete VGE, at different application levels: 1) a tool for geo-object-based multi-dimensional spatial analysis and multi-channel interaction, 2) a platform for geo-process-based simulation of dynamic geographic phenomena, and 3) a workspace for multi-participant-based collaborative geographic experiments.

The Transition Fuel to Renewable Energies

King-Lap WONG
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The Chinese University of Hong Kong

Abstract
Despite rapid advances in renewable energy research and development, fossil fuels will remain as the dominant primary energy resources for at least three more decades. As introduction, I will review the current status of development in renewable energies, and then consider various options for transition fuels before renewables can play their important roles in our society. Natural gas is the choice in the United States due to the abundant supply of shale gas, other countries may not have the same option. Some other possibilities will be presented and discussed.

Linking the environment to health: examples in air pollution

Ignatius TS YU
Clinical Professor and Associate Director (Research),
School of Public Health and Primary Care
Head, Division of Occupational and Environmental Health
The Chinese University of Hong Kong

Abstract

The effects of the environment on human health have been receiving more and more attention in recent years. Air pollution leads the league of major environmental problems for its intimacy to our daily lives and for the fact that everyone is exposed.

Researches linking air pollution to health have flourished over the past few decades and there are substantial evidences to support that air pollution has a wide range of adverse effects on health, both short term and long term.

Researchers in the Chinese University of Hong Kong have been conducting studies on the health effects of air pollution, both ambient and indoor, for two decades and have produced scientific evidences in guiding public health policies in Hong Kong and internationally.

A summary of research work linking air pollution to health conducted by CUHK researchers will be presented, focusing on the newly adopted Air Quality Health Index (AQHI) in Hong Kong and the classification of emissions from high temperature frying as a Group 2A carcinogen by the International Agency for Research on Cancer.

Recent Developments in Climate Change Research

Ngar-Cheung LAU
Institute of Environment, Energy and Sustainability
Department of Geography and Resource Management
The Chinese University of Hong Kong

Abstract

A review is offered on the utility of numerical computer models as a primary tool for climate research. The roles of complexity of model physics and spatial resolution on model performance are discussed. The principal findings of various climate change experiments and projections based on these models, as summarized in the recently-released Fifth Assessment Report of the United Nations Intergovernmental Panel for Climate Change, are described. To illustrate the impacts of climate change on local weather phenomena, the characteristics of model-simulated summertime heat waves in various parts of the globe in present and future climates are presented. These results indicate notable increases in the duration and frequency of the heat waves towards the end of the 21st century.

Poster #1

Regulatory mechanisms modulating the expression of vitellogenin gene (VGT1) gene by TCDD and Cd^{2+} in a zebrafish

Ying Ying CHEN and King Ming CHAN
School of Life Sciences, The Chinese University of Hong Kong

Abstract

Co-contamination with complex mixtures of heavy metals and polycyclic aromatic hydrocarbons (PAHs) is a common environmental problem with multiple biological consequences. In this study, we evaluated the joint estrogenic effects of cadmium (Cd^{2+}) and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in a zebrafish liver cell line- ZFL. The mRNA levels of VTG as a biomarker and estrogen receptors (ER1, ERa, ERβ1, ERβ2) were determined by exposing zebrafish liver cells（ZFL) to individual Cd^{2+} and TCDD , as well as their mixtures with different concentrations. In addition, ERE-luciferase assay was employed to determine the transcriptional regulation of VTG. Our preliminary results showed that both Cd^{2+} (at higher concentrations) and TCDD alone increased the expression level of VTG mRNA suggesting the estrogenic activity of these two chemicals. For the ERs which may mediate VTG transcription, only the expression levels of GPER and ERa were up-regulated by Cd^{2+}. When co-exposure to these two chemicals, TCDD potentiated the induction of VTG mediated by Cd^{2+}. When different deletion mutants of the zebrafish VTG-1 gene promoters made to investigate the transcriptional regulation, all of these constructs conferred Cd^{2+} induction, but their responses to TCDD induction were not significant. Co-administration of TCDD with Cd^{2+}, didn't affect the activity of 3ERE –Luc reporter induced by Cd^{2+}, indicating that VTG induction by TCDD might act on other co-activators, which requires further investigation to confirm.

Poster #2

Toxic effects of 4, 4', 5, 5' -brominated diphenyl ether (BDE-47) on zebrafish (*Danio rerio*)

Jie YANG and King Ming CHAN
School of Life Sciences, The Chinese University of Hong Kong

Abstract

Polybrominated diphenyl ethers (PBDEs) form an important class of flame-retardants used in consumer products from electronic devices and furniture. Among the 209 congeners, BDE-209 is the most widely used and commonly found PBDEs in wildlife and humans. In Hong Kong, PBDEs especially BDE-47 and BDE-99 were found from samples in fish market, and breast milk. Published studies have shown the adverse effects of PBDEs on thyroid hormone (TH) disruption. Although far away from clear clarification, among the underlying mechanisms may be disruption of TH homeostasis, neurotoxicity on the brain development and interference on the energy balance. To study the toxicities of PBDEs in the aquatic environment, we investigated the sub-lethal exposure of the predominant congener BDE-47 to the zebrafish liver cells, ZFL, using cytotoxicity assay and expression of biomarker genes detected by real time PCR method. The significant down regulation of thyroid hormone receptor β (TRβ) transcript may indicate the interference of BDE-47 with the TH feedback loop and TH actions as well through competitive binding with TH to TRβ. Besides, several key hepatic phase II metabolizing enzymes including sulfotransferases (SULTs) and UDP-glucuronosyltransferases (UGTs) were greatly affected by BDE-47. Recently, we have exposed the BDE-47 to the zebrafish larvae for 96 h post hatching (96 hph). The 20% effective concentration of BDE-47 based on deformity was then calculated at 41.8 μ M and the major deformity was the observation of crooked backbone. The mRNA expressions of genes that work along the hypothalamic- pituitary-thyroid axis (HPT) and encode the hepatic metabolizing enzymes were also profiled with BDE-47 exposure at lowest observed effective level and sub-lethal level in the zebrafish embryo-larvae.

Prospective cohort study on health effects of school environmental air quality in Hong Kong school children

Xiang Qian LAO [1, *], Arthur Pui-sang LAU [2], Adrien Kam-cheuk CHAN [2], Claudie Chiu-yi WONG [1], Ignatius Tak-sun YU [1]

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[2] Division of Environment, The Hong Kong University of Science and Technology

Abstract

Aim: To investigate the health effects of air pollution in school environments on the development of lung function and the onset of associated respiratory diseases in primary school students in Hong Kong.

Methodology: Prospective cohort study design is adopted. During 2012-2013, 26 schools were selected from the primary school list of Hong Kong. The air quality of the schools was determined through measuring various pollutants such as particulate matter, NO_x, O_3, CO_2 and total volatile organic compounds. Additionally, 100 to 150 Grade 3 to 4 students were recruited from each participating school to have their pulmonary functions measured. Parents were asked to complete a detailed questionnaire covering topics including respiratory health and socioeconomic status. Students recruited in this exercise will serve as baseline for future follow-up studies. We will collect their health data and compare the effects of different levels of air pollution on: 1) changes in pulmonary function development; and 2) incident rates of respiratory diseases from baseline to follow-up.

Results: The air pollutants concentrations varied greatly across the 26 school environments. 2675 students have been recruited. The mean age is 8.19 (0.85) years old. The common symptoms include dry cough without getting cold (28.58%), phlegm without common cold (11.89%) and wheezing (9.98%). Spirometry tests show that the lung function parameters FEV1, FVC, PEF and MFEF are 1552 (288) ml/s, 1800 (330) ml/s, 3579 (731) ml/s and 1740 ml/s, respectively.

Significance: The present study will enable us to conduct in-depth investigation of health effects of specific air pollutants on the development of pulmonary function and the onset of respiratory diseases. The data will also facilitate the development of effective policies to achieve and sustain good air quality in school environments.

Funding: This study is supported by the grant from the Research Grants Council of the HKSAR (project number: CU11688).

Poster # 4

Effects of coarse particulate matter on emergency hospital admissions for respiratory diseases: a time series analysis in Hong Kong

Hong QIU, Ignatius Tak-sun YU*, Linwei TIAN, Xiaorong WANG, Lap Ah TSE, Wilson TAM and Tze Wai WONG
Division of Occupational and Environmental Health,
School of Public Health and Primary Care, The Chinese University of Hong Kong

Abstract

Background: Many epidemiologic studies linked daily counts of hospital admissions to PM_{10} (particles with an aerodynamic diameter less than 10 μm) and $PM_{2.5}$ (particles with an aerodynamic diameter less than 2.5 μm). Fewer studies have investigated the relationship of hospital admissions with coarse particles (PM_c: particulate matter between 2.5 and 10 μm in aerodynamic diameter).

Objectives: We conducted this study to estimate the health effects of PM_c on emergency hospital admissions for respiratory diseases in Hong Kong after controlling for $PM_{2.5}$ and gaseous pollutants.

Materials and Methods: We conducted a time series analysis in Hong Kong using daily emergency hospital admissions for respiratory diseases, $PM_{2.5}$ and PM_c concentrations from January 2000 to December 2005. We estimated PM_c concentrations by subtracting $PM_{2.5}$ from PM_{10} measurements. We used generalized additive models (GAMs) to examine the relationship between PM_c and hospital admissions.

Main Results: An IQR increase in the 4-day moving average (lag_{03}) concentration of PM_c corresponded to 1.94% (95% CI: 1.24%, 2.64%) increase of emergency hospital admissions for respiratory diseases. After controlling for $PM_{2.5}$ in the two-pollutant model, the effect of PM_c on respiratory admissions was attenuated but remained statistical significant. PM_c effect estimates remained robust when adjusting for gaseous pollutants.

Conclusion: We found PM_c to be associated with emergency hospital admissions for respiratory diseases in Hong Kong independent of the effect of $PM_{2.5}$ and the gaseous pollutants. Further research is needed to disentangle the health effects associated with the different components of PM_c.

Key words: Coarse particulate matter; Emergency hospital admissions; Fine particulate matter; Generalized additive model; Respiratory diseases; Time series study

Cool and dry weather enhances the effects of air pollution on emergency IHD hospital admissions

Hong QIU, Ignatius Tak-sun YU*, Xiaorong WANG, Linwei TIAN, Lap Ah TSE, Tze Wai WONG
Division of Occupational and Environmental Health,
School of Public Health and Primary Care, The Chinese University of Hong Kong

Abstract
Background: Associations between ambient pollution and cardiovascular morbidity including ischemic heart disease (IHD) have been confirmed. Weather factors such as temperature, season and relative humidity (RH) may modify the effects of pollution. We conducted this study to examine the effects of air pollution on emergency IHD hospital admissions varied across seasons and RH levels, and to explore the possible joint modification of weather factors on pollution effects.
Methods: We collected daily time series of air pollution concentrations, mean temperature and RH, IHD hospital admissions from 1998 to 2007 in Hong Kong. We used generalized additive Poisson models with interaction term to estimate the pollution effects varied across seasons and RH levels, after adjusting for time trends, weather conditions, and influenza outbreaks.
Results: An increase in the detrimental effects of air pollution in cool season and on low humidity days was observed. In the cool and dry season, a 10 $\mu g/m^3$ increment of lag_{03} exposure was associated with an increase of emergency IHD admissions by 1.82% (95%CI: 1.24 - 2.40%), 3.89% (95%CI: 3.08 - 4.70%), and 2.19% (95%CI: 1.33 - 3.06%) for particles with an aerodynamic diameter less than 10 micron (PM_{10}), nitrogen dioxide (NO_2), and ozone (O_3), respectively. The effects of pollutants decreased greatly and lost statistical significance in the warm and humid season.
Conclusions: We found season and RH jointly modified the associations between ambient pollution and IHD admissions, resulting in increased IHD admissions in the cool and dry season and reduced admissions in the warm and humid season.

Key words: Air Pollution; Emergency Hospital Admissions; Ischemic Heart Disease; Modification; Weather factors.

Is greater temperature change within a day associated with increased emergency hospital admissions for heart failure?

Hong QIU, Ignatius Tak-sun YU*, Lap Ah TSE, Linwei TIAN,
Xiaorong WANG, Tze Wai WONG
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Abstract

Background: Although the seasonal variation and the effect of cold temperature on heart failure (HF) morbidity has been well documented, it is unknown whether the temperature variation within a day, i.e. diurnal temperature range (DTR), is an independent risk factor for HF. We hypothesized that large DTR might be a source of additional environmental stress and therefore a risk factor for HF exacerbation. We aimed to test the association between DTR and HF hospitalization, and to examine the effect modifiers such as age, gender, and season.

Methods and Results: We collected daily meteorological data and emergency HF hospital admissions from 2000 to 2007 in Hong Kong. We used Poisson regression models to fit the relationship between daily DTR and emergency HF hospitalizations, after adjusting for the time trend, seasonality, mean temperature, humidity, and levels of outdoor air pollution. We confirmed the seasonal variation of HF with peak hospital admissions in winter in Hong Kong. The adverse effects of DTR on emergency HF admissions were observed on current day and lasted for the following several days. Every 1 ^{o}C increase of DTR at lag_0 corresponded to 0.86% (95% CI: 0.31%, 1.43%) increment of emergency hospital admissions for HF. DTR exhibited significantly greater effect in cool season, on female and elderly patients.

Conclusion: Greater temperature change within a day was associated with increased emergency hospital admissions for HF. Health policy makers and hospitals may want to take into account the increased demand of specific facilities for susceptive population in winter with greater daily temperature variations.

Key Words: Diurnal temperature range; Emergency hospital admission; Heart failure; Temperature variation; Time series study

Poster # 7

The effects of particulate matter components on cardio-respiratory emergency hospital admissions in Hong Kong

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Abstract

Background: Research on how individual chemical components of PM affect human health has been focusing on fine particles (i.e., PM2.5). PM composition differs by size, with more crustal materials in coarser PM and more combustion-related components in finer PM, and thus their associated health risks could differ. Evidence regarding the health impacts on PM10 chemical composition is scarce.

Aims: We examined the short-term association between PM10 composition and daily emergency hospital admissions in Hong Kong.

Methods: Twenty-four hour concentrations of PM10 mass and eighteen components from six general air monitoring stations, daily cardiovascular (CVD) and respiratory (RESP) hospital admission data and meteorological measurements were obtained. Generalized additive models were used for the analysis.

Results: Between 2001-2007, daily average concentration of PM10 mass in Hong Kong was 54.3 μg/m3. Major contributors to PM10 included organic matter (OM), sulfate, elemental carbon (EC), nitrate, and ammonium. After adjusting for weather, seasonal/time trends, day-of-week and influenza epidemic, an inter-quartile range increment in nitrate (3.4 μg/m3) was associated with 1.8% (95% CI: 1.1−2.5 at lag 0 day) and 1.6% (95% CI: 1.0−2.3 at lag 3 day) increase in CVD and RESP hospital admissions respectively. Similar associations with OM were also found. EC, trace metals (iron, nickel, vanadium) and water-soluble ions (ammonium, sodium, potassium, chlorine ion) were linked with increased hospital admissions, particularly in the cool season. Stronger effects were observed for admissions among elderly (65 years) and RESP admissions among men.

Conclusions: Ambient levels of secondary particles (nitrate) and OM that is primarily from combustion were associated with the largest risks of hospital admissions across the PM10 components in Hong Kong. Potential seasonal influence and effect modifiers for PM10 composition-related health effects warrant further investigation.

Poster # 8

Exposure to incense smoking and lung cancer risk in Hong Kong men

Lap Ah TSE[1], Ignatius Tak-sun YU[1], Hong QIU[1],
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Abstract
Aim of study: Burning incense to worship Gods and ancestors is a long traditional practice in many homes of Hong Kong whilst the emitted air pollutants are regarded as the major environmental health problem. This study aimed to examine the association between incense smoke and lung cancer risk among Hong Kong Chinese men.
Methodology: This case-referent study included 1208 male lung cancer incident cases and 1069 community referents. We collected information from each case and referent regarding their incense smoke and other residential indoor air pollutants, residential radon, lifetime smoking habit, and other risk factors. We performed unconditional multiple logistic regression analysis to estimate the odds ratio (OR) after adjusting for possible confounding factors and investigate the possible multiplicative or additive-scaled interaction.
Results obtained: A statistically significant additive-scaled interaction [synergy index=1.59, 95% confidence interval (CI), 1.06-2.61] was observed between cigarette smoking and high cumulative incense exposure (≥60 times-years) on lung cancer risk, and the risk was enhanced when further exposure to high level of residential radon (OR=2.18, 95%CI: 1.21-3.92). Associations appeared clearer with cumulative incense exposure than using the frequency of incense burning as another exposure indicator. We did not observe an association between incense exposure and lung cancer among never smokers.
Discussion and significance: This study strongly suggests that efforts to prevent lung cancer in the community should include the reduction or minimization of exposures to indoor air pollutants, as well as smoking cessation.
Conclusion: Cigarette smoking is probably prerequisite to the occurrence of lung cancer among men exposed to incense smoke, and an enhanced risk may occur with joint exposure to high level of residential radon.
Funding: Research Grants Council of the Hong Kong Special Administrative Region, China, project CUHK4460/03M.)

Occupational exposures and lung cancer risk in Hong Kong men

Lap Ah Tse[1], Ignatius Tak-sun Yu[1], Hong Qiu[1], Joseph Siu Kai AU[2], Xiao-rong WANG[1]
[1]JC School of Public Health and Primary Care, The Chinese University of Hong Kong
[2]Department of Clinical Oncology, Queen Elizabeth Hospital, Kowloon

Abstract

Aim of study: This study aims to quantify the associations between occupational exposures and lung cancer risk in Hong Kong men.

Methodology: We conducted a population-based case-referent study during 2004-2006. Full occupational histories and other major risk factors of lung cancer for 1208 male lung cancer incident cases and 1069 age-matched male community referents were obtained. Specific or group of agents of confirmed or suspected occupational carcinogens were collected according to a standardized checklist.

Results obtained: After adjustment of smoking and other potential confounders, a significantly increased odds ratio (OR) of lung cancer was observed for workers employed in the 'construction' industry (1.37, 95%CI: 1.00-1.89; ISIC code: 5) and the occupation of 'bricklayers, carpenters and other construction workers' (1.49, 95%CI: 1.07-2.06; ISCO code: 9-5). Significantly elevated ORs were associated with exposures to silica dust (1.75, 95%CI: 1.16-2.62), welding fumes (1.74, 95%CI: 1.13-2.68), diesel exhaust (2.18, 95%CI: 1.23-3.84), and man-made mineral fibers (7.45, 95%CI: 1.63-34.00); while a significantly reduced OR (0.67, 95%CI: 0.47-0.95) was linked to cotton dust. Because both the cases and community referents were a representative sample of the general population, we estimated that 3.2% (95%CI: 0.1-7.3%) of lung cancer in Hong Kong male population was attributable to the employment of construction industry and the population attributable fraction was 9.5% (95%CI: 4.8%-15.1%) for exposures to any of the four identified occupational lung carcinogens (i.e., silica dust, welding fumes, diesel exhaust, and man-made mineral fibers).

Discussion and significance: Occupational risks for lung cancer and the burden among Chinese men remain unclear, and this large population-based case–referent study has filled in this knowledge gap. Conclusions: Our study demonstrates that previous exposures to occupational carcinogens are the important lung cancer determinants for Hong Kong Chinese men.

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Preliminary results of a case-control study of Bisphenol A and breast cancer among Hong Kong women

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Abstract
Aim of study: Breast cancer is the leading cause of cancer morbidity and mortality among women in Hong Kong, and the rate is accelerating. Bisphenol A (BPA) is one of known endocrine disruption chemicals (EDCs) commonly used in food and beverage containers of our daily life. The estrogen-mimic BPA has been suspected as a potential risk factor of cancer. Results from animal studies confirmed it carcinogenesis in mouse mammary. However, there is little epidemiologic evidence about BPA and human breast cancer. We hypothesize that BPA exposure may increase the risk of breast cancer. We aim to present the preliminary results of an ongoing case-control study of breast cancer among Hong Kong women.
Methodology: We are consecutively recruiting all newly diagnosed breast cancer cases and age-matched controls from several hospitals and we expect to collect 1,066 cases and 1,066 controls by the end of 2013. A standardized questionnaire was used to collect information on each participant's lifetime exposure to BPA, environmental exposures to pesticides and other EDCs, occupational exposures, reproductive and anthropometric factors, smoking, diet, alcohol drinking, family cancer history, etc. Lifetime BPA exposure level was evaluated by a validated Index.
Results obtained: We have obtained 457 breast cancer cases and 314 controls with a response rate of 92%. The age distribution at the diagnosis of breast cancer (54.2±12.0 vs. 53.6±14.2, p=0.531) for the cases and controls are comparable. A slightly more controls (38.1%) than the cases (26.7%) had more than 2 children. The BPA exposure was no significant difference between case and control groups (p = 0.491). Similar result also be found after adjusting several important confounders.
Conclusions: This study showed preliminary results regarding the basic characteristics of an ongoing case-control study of breast cancer in Hong Kong women. The preliminary result didn't support our hypothesis.
Acknowledgement: Research Grants Council, Hong Kong (Project no. 474811).

Poster #11

Exposure to household cleaning products and respiratory health effects in Hong Kong young schoolchildren

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Abstract:

To investigate the respiratory health effects of using household cleaning products at home in Hong Kong young schoolchildren, a one year prospective cohort study was designed with target population of children in grades two to four. Primary schools in HK were randomly selected among the four regions (HK/outlying islands, Kowloon, N.T. East, and N.T. West). Self-administered questionnaires were completed by parents/guardians to collect information on weekly frequency of use and duration of each use of 13 types of cleaning products, prevalence of respiratory symptoms and diseases, and other home characteristics. Multiple logistic regression was applied to assess the associations. Covariates of age, sex, lifestyle and socio-economic factors were included for controlling confounding effects. The same questionnaires would be administered after one year. A total of 3,876 children from 22 schools were invited, and 2,675 (69.0%) agreed to participate from May 2012 to July 2013. 2,145 children returned consent forms and questionnaires. 1,992 of them had been living in same home address for at least 12 months and were included in the analysis. 1,005 (50.5%) boys and 987 (49.5%) girls were similar in age (8.18y/o and 8.20y/o). However, wheezing, sneezing/congested nose, asthma, allergic rhinitis, sinusitis and bronchiolitis were more prevalent in boys. Children in home with the frequent use of the cleaning products generally had increased odds ratios in having wheezing and allergic rhinitis, while those with longer duration use had significantly increased adjusted odds ratios in having frequent dry cough and phlegm. The use of bleach solutions was commonly observed to be associated as a possible risk factor for various respiratory symptoms/diseases (wheezing, dry cough, phlegm, allergic rhinitis and bronchitis). The use of cleaning products at home seemed to have some adverse effects on respiratory health of young schoolchildren, but the associations observed should be confirmed after the follow-up study.

Domestic incense burning and the risk of nasopharyngeal carcinoma: a case-referent study among Hong Kong Chinese

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ABSTRACT

Aim of Study: This study aimed to investigate the effect of incense burning on the risk of nasopharyngeal carcinoma (NPC) among Hong Kong Chinese.

Methodology: We conducted a case-referent study among Hong Kong Chinese. Between June 2010 and December 2012, we recruited 352 incident cases and 410 referents. We collected information on lifelong exposures to incense smoke via face-to-face interviews. Logistic regressions were performed to estimate the odds ratios (ORs) for NPC associated with incense burning.

Results obtained: We observed an increased risk of NPC associated with daily burning in women (adjusted OR = 2.49, 95% CI: 1.33, 4.66) but not in men (adjusted OR = 0.96, 95% CI: 0.63, 1.45). The OR in women increased with higher categories of cumulative exposure, showing exposure-response relationships. Comparing to those without daily burning, women with daily burning for over 40 years were at significantly elevated risk of NPC (adjusted OR = 4.33, 95% CI: 1.81, 10.36). Poor ventilation and co-exposures to other indoor inhalants could have enhanced the effect of incense burning on NPC risk. The adjusted OR for daily burning in poor ventilation conditions was 2.08 (95% CI: 1.02, 4.24), while that in good ventilation was 1.35 (95% CI: 0.92, 1.98). The adjusted OR for combined exposures to incense smoke and at least two of other indoor inhalants was 4.20 (95% CI: 1.87, 9.43).

Discussion and Significance: The more profound effect in women may be explained by the fact that Chinese women spend more time at home and more likely to be exposed to incense smoke. Poor ventilation may result in prolonged high levels of carcinogenic inhalants, and thus, have increased NPC risk related to incense burning. Attention should be devoted to the excess risk of NPC resulting from common exposures to indoor inhalants in the population.

Conclusion: This study provided good evidence for an increased risk of NPC associated with incense burning. Future large-scale studies with refined exposure assessment may help better document the possible causal association.

Wheeze during the first 18 months of life: Exploring the associations with indoor nitrogen dioxide and formaldehyde

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Abstract

Aim: To investigate whether exposures to nitrogen dioxide (NO_2) and formaldehyde at home would increase the risk of wheezing in the first 18 months of life.

Methods: A total of 2,423 young infants born in Hong Kong from 1st April 2008 to 31st March 2009 were recruited from 29 Maternal and Child Health Centers. They were stratified into 3 groups: having a family history of asthma, allergy and no family histories of asthma or allergy. Roughly equal numbers coming from each group were selected by systematic sampling into a cohort of 702 infants. Parents were interviewed with the modified International Study of Asthma and Allergies in Childhood questionnaire to obtain baseline information on respiratory health, family and home environment characteristics when the infants were 4 months old. NO_2 and formaldehyde were measured in the infants' bedrooms at 5 months old. With the aid of a respiratory health diary, parents recorded and reported infants' respiratory symptoms and illnesses until 18 months old through monthly telephone interviews. New onset wheezing between 6 and 18 months old was used as the outcome. Cox's proportional hazards model was used to document the effects of NO_2 and formaldehyde on the risk of wheeze after adjusting for possible confounders.

Results: 528 subjects completed all observations and air sampling, giving a completion rate of 75.2%. 58 infants (11.0%) had new onset wheeze within the observation period between 6 to 18 months old. Indoor exposure to formaldehyde was significantly associated with the risk of new onset wheezing, with 4% increase (95% CI: 1%, 7%; p value = 0.02) for each 10 g/m^3 increase in formaldehyde. Indoor exposure to NO_2 did not seem to have any significant effect on the risk. Stratified analysis showed that the infants with a family history of allergy were particularly sensitive to formaldehyde. Compared to infants exposed to formaldehyde <20 g/m^3, those with exposure ≥60 g/m^3 had a hazard ratio of 2.45 (95% CI: 1.09, 5.52; p value = 0.03). **Conclusion:** An indoor exposure to high level of formaldehyde increased the risk of new onset of wheezing, especially among infants with a family history of allergy.

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Poster # 14

Synergy between particles and nitrogen dioxide on emergency hospital admissions for cardiac diseases in Hong Kong

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Abstract

Background: Ambient air pollution is a complex mixture of particles and gaseous pollutants. Epidemiological studies are moving toward a multipollutant approach, requiring an understanding of possible interactions among the pollutants. We aim to estimate the joint effects of particles with an aerodynamic diameter less than 10 μm (PM_{10}) and nitrogen dioxide (NO_2) on emergency hospital admissions for cardiac diseases, and to explore the possible interactions between PM_{10} and NO_2.

Methods: We collected daily time series data from 1998 to 2007 on emergency hospital admissions for cardiac diseases in Hong Kong, as well as PM_{10} and NO_2 concentrations. Generalized additive Poisson model was used to examine the relationship between air pollution and hospital admissions. We then used three parallel time series approaches (bivariate response surface model, joint effect model and parametric stratified model) to explore the possible interactions between PM_{10} and NO_2.

Results: Results showed the greatest joint effect of PM_{10} and NO_2 on emergency cardiac hospitalizations when PM_{10} and NO_2 concentrations were both at high levels. The effect of PM_{10} was significantly greatest on the days with high NO_2 level, and vice versa. A 10 $\mu g/m^3$ increase of lag_0 PM_{10} and NO_2 was associated with an increase of emergency cardiac hospitalizations by 0.55% (95%CI: 0.29-0.80%) and 1.20% (95%CI: 0.87-1.53%) respectively, when the other pollutant was at high level.

Conclusions: We found consistent synergistic interaction between PM_{10} and NO_2 on emergency cardiac hospitalizations in Hong Kong. These findings contribute to the development of a new paradigm for multipollutant air quality management.

Key words: Cardiac disease; Emergency hospital admission; NO_2; PM_{10}; Synergy.

Poster # 15

Effect of aerosol phase on the heterogeneous oh oxidation of succinic acid aerosols: reaction kinetics and product identification using direct analysis in real time mass spectrometry

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Abstract

The effect of aerosol phase (solid versus aqueous) on the heterogeneous OH oxidation of succinic acid is investigated using an aerosol flow tube reactor. The molecular transformation of the aerosol is measured using Direct Analysis in Real Time (DART), a soft ambient ionization source, coupled with a high resolution mass spectrometer. Aerosol phase is observed to have a pronounced effect on the reaction kinetics and the distribution of the oxidation products. In highly concentrated aqueous droplets (~28 Molar), succinic acid decays 24-50 times faster than in solid aerosols producing a larger quantity of both functionalization and smaller molecular weight fragmentation aerosol phase oxidation products. These observations are consistent with the more rapid diffusion of succinic acid and its reaction products to the surface of the aqueous aerosol. For aqueous aerosol, higher molecular weight functionalization products account for a maximum of ~10% of the aerosol mass compared to lower molecular weight fragmentation products, which account for nearly 70% of the aerosol mass over the course of the reaction. For solid aerosol, unreacted succinic acid is the dominant aerosol constituent with functionalization products accounting for < 1% and fragmentation products accounting for ~8% of the aerosol mass. Based on exact mass measurements of the oxidation products and a proposed reaction mechanism, succinic acid in both phases is preferentially oxidized to form smaller monacids and diacids (e.g. oxalic acid). These results illustrate the importance of water in controlling the average elemental composition of the aerosol through the formation and evolution of C-C bond scission products with high carbon oxidation states and small carbon numbers.

Poster # 16

Forecasting daily air quality in Hong Kong by using a hybrid statistical-dynamical approach

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Abstract

A hybrid statistical-dynamical model has been developed for predicting the next-day air quality for Hong Kong. In this approach, generalized additive models (GAMs) linking air pollutant concentration with meteorological data were first constructed, based on observations at urban (including Sham Shui Po, Western District, Eastern District and Kwun Tong) and sub-urban sites (Tung Chung) provided by the Environmental Protect Department and meteorological measurements from nearby stations from the Hong Kong Observatory, during the 2000-2009 period. GAMs were then combined with weather predictions from either (1) Global Forecast System global (GFS) products or (2) dynamically downscaled GFS results using WRF (GFS-WRF) to give local air quality forecasts. The system was verified by carrying out historical daily air quality predictions in 2010. It was found that, in general, downscaled weather forecasts from GFS-WRF combined with GAMs give better results than those based on GFS products. In general, the statistical-dynamical model with GFS-WRF inputs performed well in forecasting both urban and sub-urban RSP, O_3 and NO_2 concentrations. However, the SO_2 concentration was over-estimated (with a root-mean-square error of about 7.7 ug/m^3 for GFR-WRF); the discrepancy can be attributed to uncertainties in emission source and meteorological predictions. The R^2 values of GFS and GFS-WRF-based Air Pollution Index (API) predictions are 0.27 to 0.35 in sub-urban, and 0.39 to 0.47 in urban areas, respectively. The Hit Rate (False alarm Ratio) for categorical forecasts of events with daily API>100 given by GFS-WRF is also higher (lower) than that using GFS only. The improvement is mainly due to better predictions of wind speed when WRF is implemented. Overall, our results indicate that the statistical-dynamical model may be considered as a useful tool for air quality prediction for urban and sub-urban sites in Hong Kong.

Poster # 17

Vanadate doped ag_3po_4 and its enhanced photoactivity and durability

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Abstract

The photolysis of water catalysed by semiconductors is a promising approach for solar energy utilization. Active semiconductor photocatalysts that can directly split water under visible-light irradiation have attracted much attention. Ag_3PO_4 as a new photocatalyst has been reported recently. The quantum efficiency of the new material can be up to 90% under visible light, much higher than conventional visible light-driven photocatalysts such as $BiVO_4$ and WO_3. Ag_3PO_4 shows high photo-oxidative capabilities for O_2 evolution as well as dye degradation. Additionally, different morphologies of Ag_3PO_4 were synthesized and the facet effect of Ag_3PO_4 has also been studied. Ag_3PO_4 bounded with {110} and {100} planes showed much higher activity than amorphous one. However, there is a critical problem hindering the application of this novel photocatalyst. Ag_3PO_4 shows poor stability under visible light irradiation. The silver ion in the compound is easily reduced reduced to silver particles, a very poor photocatalyst.

In this work, vanadate doped silver phosphate nanoparticles were synthesized by solvothermal methods. The obtained nanoparticles showed a rare pyramid morphology of size about 150 nm. The activity of V-doped Ag_3PO_4 for photo-oxidation of water was higher than that of pure silver phosphate. More importantly, the photocatalyst showed much better stability under visible light irradiation. The enhancement of photocatalytic activity and stability is probably due to the lattice distortion and charge redistribution around the dopants.

Poster # 18

Food waste-based biorefinery development: valorisation of food waste for sustainable production of chemicals, materials and fuels

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Abstract

In Hong Kong, there are around 3,600 tonnes of food waste generated, which is made up of 40% of Municipal Solid Waste (MSW). Fifty-two percent (52%) of the MSW generated is dumped into landfills. It is estimated that by 2018, all current landfill sites in Hong Kong will be exhausted. Exploiting food waste and by-product streams generated by the food and beverage industry, for chemical and material production could create integrated, sustainable and bio-based processes. Local or regional production of bio-based chemicals and materials could be supported through integration of new technologies in existing industrial plants where waste or by-product streams could be exploited as raw material for chemical and material production. This synergistic approach could create significant added-value, will require less capital investment, will create new job opportunities, will expand the market outlets of existing industrial sectors and reduce environmental impact of existing plants. Furthermore, this approach could lead to a smoother transition from the petrochemical to the bio-economy era. This presentation will focus on the valorization of food waste for sustainable production of chemicals, materials and fuels. It will emphasize on the potential of microbial bioconversion as a core unit operation for the production of chemicals and polymers as major commodities generated by such integrated food waste-based biorefinery. The prospects of such bio-based processes will be illustrated by specific case studies in Hong Kong and their techno-economic studies.

Poster # 19

Isolation and mRNA expression of Hypoxia-inducible Factor α (HIF-α) in *Nassarius siquijorensis* and *N. conoidalis*

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Abstract

Hypoxia-inducible factor (HIF) is commonly found in vertebrates as an adaptation against hypoxia. In this study, partial sequences of HIF were first reported for subtidal nassariid gastropods, *N. siquijorensis* and *N. conoidalis*. The phylogenetic tree of HIF-α among various animal groups was inferred. Adults of both *N. siquijorensis* and *N. conoidalis* were exposed to short-term (24 hours) and long-term (1 week) hypoxia (1.5 mg O_2 l^{-1}) and the change of HIF-α relative to housekeeping gene (β-actin) was determined in gill, foot muscle and hepatopancreas by using quantitative real-time PCR. The expression profile of HIF-α was also investigated in veliger larvae after 1 and 24 hours hypoxia exposure. The HIF-α mRNA from gills of *N. siquijorensis* was 2.22-fold elevated after 24 hours of exposure but returned back to the baseline level after 1 week of exposure. In contrast to *N. siquijorensis*, both short-term and long-term exposure to hypoxia significantly enhanced the mRNA level of HIF- α in the gill of *N. conoidalis*. Both 24 hours and 1 week of exposure resulted in a significantly higher degree of expression of mRNA of HIF-α in the foot muscle of *N. siquijorensis* and *N. conoidalis*. For hepatopancreas, the mRNA level of HIF-α remained unchanged in *N. siquijorensis* after both 24 hours and 1 week of exposure to hypoxia but a significant enhancement was observed in *N. conoidalis* after 1 week of exposure to hypoxia. The mRNA level of HIF-α remained unchanged in the larvae of *N. conoidalis* after 1 hour and 24 hours of exposure to hypoxia, in contrast, a significant reduction was observed after 24 hours of exposure to hypoxia in *N. siquijorensis*. The different expression patterns of HIF-α mRNA between the two species reflected their different adaptation abilities to hypoxia, which will further explain the differences in the distribution of these species in Hong Kong waters with *N. siquijorensis* being predominant in regions suffered from summer hypoxia.

Poster #20

Population structure of two indigenous freshwater fish species (*Liniparhomaloptera disparis* and *Rhinogobius giurinus*) with different life history patterns

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Abstract

Hong Kong is one of the most densely populated cities in the world. Yet, in such a small and highly urbanized city (1,104 km^2), an unexpectedly high biodiversity in terms of freshwater ichthyofauna is observed, with more than 160 freshwater fish species being recorded. Despite the high diversity and ecological importance of indigenous freshwater ichthyofauna, organized and comprehensive baseline surveys have not been conducted in Hong Kong until recent years, and majority of these studies have been focused on the ecological and taxonomic aspects, and hardly any genetic studies have been conducted. In this study, we investigated the genetic diversity and population differentiation of two selected indigenous fish species, the broken-band hillstream loach *Liniparhomaloptera disparis* and the barcheek goby *Rhinogobius giurinus* using a multi-locus approach. Analyses on the partial sequences of mitochondrial control region and cytochrome *b* genes on the two fish species show very different genetic population structure. Population genetic analyses on >100 individuals collected from 27 localities revealed a moderate yet significant structuring between *L. disparis* resided in Lantau Island and the New Territories (genetic divergence: ~1%). Genetic structuring was also found in *L. disparis* inhabited in the New Territories. On contrary, no population structure can be detected in the goby *R. giurinus*. We hypothesize that life history pattern plays a fundamental role in shaping the population structure of the two fish species. As a primary freshwater fish species, *L. disparis* completes the life cycle in hill streams. This may reduce the mobility of the fish to migrate or disperse from their home streams to other hill streams, and the reduction of gene flow may lead to the observed population structuring. On the other hand, *R. giurinus* is amphidromous, with its juveniles migrating from streams to low elevation habitats such as ponds and estuaries. The migratory behaviour may allow high level of gene flow between river systems through these large water bodies, resulting in a lack of genetic structure in *R. giurinus.*

[This work was fully supported by the Environment and Conservation Fund, HKASR Government.]

Poster # 21

Algal cultivation with lipid production under the variation of NP conditions

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Abstract
In order to mitigate the global energy crisis, microalgae has been used as an energy resource in recent decades. One of the applications of the microalgae is the production of biodiesel via trans-esterification of microalgae. Nitrogen (N) and Phosphorus (P) are essential factors for microalgae growth. To optimize the algal lipid content, variation of nitrogen and phosphorus condition is one of important factors. In this study, four conditions, including i) Normal-N with P-limited; ii) N-limited with Normal-P; iii) N-limited with P-doubled; iv) Normal-N with Normal-P, will be used to investigate the algal biomass production and lipid production. The normal condition of nutrient supply is in accordance with the concentration of primary settled wastewater in Shek Wu Hui Wastewater Treatment Plant. Results show that the highest algal lipid content (24%) is in post-stationary growth phase under N-limited condition, but the algal biomass is lower (0.52 g/L) with its total lipid (0.12 g/L). So, in order to optimize the highest total lipid, biomass and lipid content production should be concerned. It is found that the highest total lipid (0.2 g/L) is under normal N and P condition. Besides, the result shows that the assimilation of nitrate is determined by the concentration of phosphorus for algal mass cultivation. To conclude, the highest biomass production is under normal N and P condition while the highest lipid content production is under N-limited condition.

Keywords: Microalgae, cultivation, lipid, NP condition

Poster # 22

A novel photobioreactor with built-in led light system for cultivation of microalgae

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Abstract:
In order to cultivate a pure algal strain for industrial use, photobioreactor is one of the technologies adopted in recent decades. In this preliminary study, a novel photobioreactor with internal illumination system is examined. It consists of 3-colored LED lights, including white, red and blue, built in the close-end Plexiglas for algal cultivation. The light is concentrated which provides an even illumination to microalgae inside the reactor. With this built-in design, the illumination may be optimized for microalgae growth. The results show that the algal biomass in white, red and blue light are 0.378± 0.018 g/L, 0.287± 0.043 g/L and 0.225± 0.025 g/L respectively. Besides, 21.43%, 17.62% and 12.57% of lipid content are found in these 3 LED lights respectively. To conclude, with different LED light sources, the growth and lipid production of microalgae will be different. It was found that the white LED light is the best choice to be used in photobioreactor for cultivation.

Keywords: internal illumination, LED, microalgae, photobioreactor, Plexiglass.