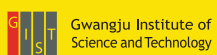




The **19th** International Conference of the
Pacific Basin Consortium for Environment and Health (PBC)
Hosted by IERI, GIST

ENVIRONMENTAL EXPOSURES IN A CHANGING CLIMATE

AUGUST 29 - SEPTEMBER 1, 2022 | Maison GLAD Jeju Hotel Korea



WELCOME ADDRESS



Dear distinguished participants !

I am very pleased to host this meeting “The 19th International Conference of the Pacific Basin Consortium for Environmental and Health (PBC) in 2022” at Maison GLAD Jeju Hotel, Korea. Located in the South Sea of Korea, Jeju Island is a beautiful destination with magnificent natural features that was officially selected as one of the 7 scenic spots in the world. I hope that it will be a place where your bodies and minds can be healed from the exhaustion and major disruptions caused by COVID-19 pandemic.



This conference will be great opportunity for the international collaboration and we can share lots of experiences in the field of environment and health issues. Today we are very fortunate to have excellent speakers from most Asia-Pacific regions including Australia, Cambodia, Fiji, India, Indonesia, Mongolia, Laos, New Zealand, Philippines, Thailand, Uruguay, USA, Vietnam and several others.



Lastly, we have several sponsors for this meeting including Pacific Basin Consortium, Gwangju Institute of Science and Technology (GIST), International Environmental Research Institute (IERI), National Institute of Health (NIH), USA and Jeju Convention Bureau (JCVB). We greatly appreciate the supports of these sponsors and the dedication of those who prepared the conference to make it a valuable platform for experiences and research exchange.

Kyoung-Woong Kim
PBC 2022 Conference President



The **19th** International Conference of the
Pacific Basin Consortium for Environment and Health (PBC)
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PBC 2022 PROGRAM

Pre-conference Training Workshops

01 Children's Environmental Health

In general, children receive a higher “dose” of toxicants in a given environment, are less able to neutralize toxicants and live long enough for diseases with long latency periods to manifest. This workshop will cover the principles underlying the vulnerability of children and will highlight risks in specific environments. This workshop is part of a series organised by staff from the Network of WHO Collaborating Centres for Children's Environmental Health at previous PBC conferences. This workshop provides an opportunity for engagement of a wider audience and additional training with evaluation materials made available to trainees.

02 Integrated Environmental Health Risk and Impact Assessment

This workshop offers a refresher on understanding some of the practical risk assessment methods - from the most basic to a more complex integration of risk and impact assessment.

03 Identification of Priority Actions for Regional Collaboration

To share a great insight into the challenges and future needs in conducting effective carbon mitigation policies and activities based on the dynamic networking platform between researchers, policymaker and government-related institutes in Asia-Pacific Region

IP _ In Person V _ Virtual

29 AUGUST 2022 DAY 1

12:00 - 15:30	Pre-conference Training Workshops & Registration	
12:00 - 13:30	Identification of Priority Actions for Regional Collaboration	
	IP	Hyun Sik Chang (Ewha Womans University) - Korea's ODA & SDGs : Climate Change
	IP	Suil Kang (IERI, GIST) - Strengthening Endogenous Capacities and Technologies
	IP	Hanna Cho (KEI) - Climate change impacts and adaption
13:30 - 14:00	Break	
14:00 - 15:30	Integrated Environment Health Risk and Impact Assessment	
	IP	Jimmy Jaghoro Hilly (University of New South Wales, UNSW, Australia)
	IP	Injeong Kim (KITECH, Korea)
	V	Dee Lewis (University of Guelph, Canada)
	V	Angie Werner (NCEH, USCDC, USA)
	V	Colleen Lau (University of Queensland, Australia)
	IP	Paul Jagals - (University of Queensland, Australia)
	Children's Environmental Health	
	IP	Peter Sly (University of Queensland, Australia) - Vulnerability of Children to environmental exposures
	IP	Stephania Cormier (Louisiana State University, USA) - Air pollution and Children's Health
	V	Antonio Pascale (University of Montevideo, Uruguay) - Impacts of pesticide exposure in childhood
15:30 - 16:00	Break	
16:00 - 17:00	Opening Ceremony	
	IP	Stephania Cormier (Chair, PBC Board of Directors)
	IP	Kyoung-Woong Kim (Conference President)
	IP	Akeem Ali (Head of Office, WHO Asia-Pacific Centre for Environment and Health)
	Opening Address	
	V	Hyun Kim (WHO Climate Change Project Coordinator) Health resilience to climate change
17:00 - 18:30	Plenary 1: Environmental Exposures in the Asia-Pacific Region in a Changing Climate	
	Chair : IP Paul Jagals (University of Queensland)	
	Co-chair : V Ayaho Yamamoto (University of Queensland)	
	Speakers	
	Keynote Speaker : IP Youn-Joo An (Konkuk University) - Effects of microplastics in ecosystems and its implications for human health	
	IP	Lunchakorn Prathumratana (SWITCH-Asia) - Climate policies in tackling climate change
	V	Budi Haryanto (University of Indonesia) - Impact of climate change on environmental exposures in Indonesia
18:30 -	Welcome Party	



30 August 2022 DAY 2

08:00 - 09:00	Registration
09:00 - 10:30	<p>Plenary 2 : Environmental Impacts on Infectious Disease [from 2021 Focus Meeting] Chair : V William Suk (NIEHS) Co-chair : IP Sujung Lee (GIST)</p> <p>Speakers IP Dwan Vilcins (University of Queensland) - Oxidative stress as a mediator of respiratory disease V Ayaho Yamamoto (University of Queensland) - Environmentally Persistent Free Radicals increase susceptibility to Sars CoV-2 infection IP Peter Sly (University of Queensland) - Age as a susceptibility factor for SARS-Cov2 infection</p>
10:30 - 11:00	Break
11:00 - 12:30 (3 Parallel Sessions)	<p>Symposium 1 : New Trends in Air Pollution Chair: IP Stephania Cormier (LSU) Co-chair : IP Jimmy Jaghoro Hilly (UNSW)</p> <p>Speakers V Guofeng Shen (Peking University) - Exploring internal and outdoor sources contributions to indoor air pollution using highly resolved temporal data IP Per Blomqvist (Research Institutes of Sweden) - Emissions from Electric Vehicle Fires IP Atar Singh Pipal (Dr Bhimrao Ambedkar University, India) - Exposures to fine particulate matter (PM2.5) and its effects on pre-term birth and related outcomes IP Jin-Ho Yoon (GIST) - Changes in fire weather climatology under warmer climate</p> <p>Symposium 2 : Water Chair : IP Kyoung-Woong Kim (GIST) Co-chair : IP Lilyananda Reta Puspasari (GIST)</p> <p>Speakers IP Yunho Lee (GIST) - Occurrence, Removal and Risk Assessment of Organic Micropollutants in Wastewater Treatment Plants IP Windi Muziasari (University of Helsinki) - Antibiotic resistomes and microbiomes in the surface water along the Code River in Indonesia reflect drainage basin anthropogenic activities IP Injeong Kim (KITECH) - Development of method for estimating chemical emissions to the water environment from occupational use of consumer chemical products IP Lilyananda Reta Puspasari (GIST) - Machine Learning for Flood Prediction in Indonesia: Providing Online Access for Disaster Management Control</p> <p>Symposium 3 : Heavy Metals Chair : IP Tahir Rafique (PCSIR) Co-chair : IP Randy Novirsa (Andalas University, Indonesia)</p> <p>Speakers V Yoojin Choi (Chung-Ang University) - Biological synthesis of inorganic nanomaterials using microorganisms</p>

	<p>IP Dr Mahfuzar Rahman (Pure Earth, Bangladesh) - Hidden crisis of Lead poisoning in Bangladesh IP Sujung Lee (GIST) - Effects of Temperature on soil geochemical properties and heavy metals accumulation in <i>Brassica Napus L.</i> IP Randy Novirsa (Andalas University, Indonesia) - Potential methylmercury exposure of rice consumption and public health impacts in Indonesia</p>
12:30 - 13:30	Lunch - Board of Directors AGM
13:30 - 15:00 (3 Parallel Sessions)	<p>Symposium 4 : Persistent Organic Pollutants (PCB, Dioxins) Chair: IP Rajendra Prasad (Technology-Patent.com) Co-chair : V Priyanka Agarwal (Dr BR Ambedkar University, India)</p> <p>Speakers IP Aimin Chen (UPenn) - POP exposure in early life V Atsuko Ikeda-Araki (Hokkaido University) - Impact of environmental chemical exposure on childhood infections V Priyanka Agarwal (Dr BR Ambedkar University, India) - Prenatal exposure to polycyclic aromatic hydrocarbons (PAHS) and birth size V Sengoda Grounder Rajamani (AIUEC) - Remediation of mercury contaminated sensitive site and soil by adopting unique two stage process of water wash and retard</p> <p>Symposium 5 : Emerging and Re-emerging Infectious Diseases Chair: IP Zahir Islam (University of Queensland) Co-chair: IP Syamsuar Manyullei (Hasanuddin University)</p> <p>Speakers V Rebecca Carriere Christofferson (LSU School of Vet Med) - Climate change and emerging and re-emerging mosquito-borne viruses. In Emerging and re-emerging infectious diseases V Helen Mayfield (University of Queensland) - Using mosquitoes for surveillance of vector-borne diseases IP Syamsuar Manyullei (Hasanuddin University) - Is The Existence of Breeding Places and Cattle Pens A Risk Factor for The Incidence of Filariasis in Indonesia? V Morgan Lemin (University of Queensland) - Environmental Factors Associated with Lymphatic Filariasis Infection in American Samoa: An Analysis to Enhance Current Surveillance and Elimination Strategies</p> <p>Symposium 6 : Hazardous Waste Remediation Chair: IP Rengaraj Selvaraj (Sultan Qaboos University) Co-chair: IP In-Ho Yoon (KAERI)</p> <p>Speakers IP In-Ho Yoon (KAERI) - Radionuclide (Cesium) behavior in various clays of the decommissioning site of nuclear facilities : batch, XRD, and EXAFS techniques IP Rengaraj Selvaraj (Sultan Qaboos University) - Green 2D nanostructured materials for the degradation of hazardous waste present in water and wastewater IP Rehnuma (Haque) Sarah (ICDDR, B, Stanford University) - Exposure to Lead and Risk of SARS-CoV-2 infection among Ready Made Garment (RMG) workers in Bangladesh IP Tahir Rafique (PCSIR Labs, Pakistan) - Assessment of High Nitrate Concentration in Soil of Thar Desert, Pakistan and its Removal from the Groundwater</p>



31 August 2022 DAY 3

15:00 - 15:30	Break
15:30 - 17:00	Poster Session Chairs : IP Michelle Heacock IP Brittany Trottier
	<p>IP Madhu Anand (Dr BR Ambedkar University, India) - Persistent Organochlorine pesticides exposure and breast cancer among Indian women : a possible linkage</p> <p>IP Satbyul Estella Kim (University of Tsukuba, Japan) - Ambient Particulate Air Pollution and Premature Mortality in Two Asian Megacities</p> <p>IP A.Muh. Faudzul Adziim (Hasanuddin University, Indonesia) - Sociodemographic factors and spatial analysis that contribute to the development of leprosy in coastal setting</p> <p>IP Mahabuba Afrin (Hiroshima University, Japan) - Identifying determinants of multidrug-resistant tuberculosis in Bangladesh : A case-control study</p> <p>IP Huiho Jeong (Prefectural University of Kumamoto, Japan) - Risk assessments of mercury on the past MSW (municipal solid waste) landfill forest soil in 2022</p> <p>IP Md Jiaur Rahman (Hiroshima University, Japan) - Prevalence of asymptomatic urinary abnormalities among the school-going adolescents in the rural area of Bangladesh</p> <p>IP Md Moshir Rahman - Impact of the COVID-19 pandemic on child immunization in Bangladesh</p> <p>IP MD Marufur Roshid (Hiroshima University, Japan) - Assessment of quality of life in cancer patients during the COVID-19 pandemic in Bangladesh</p> <p>V Laxmi Singh (Dr. Bhimrao Ambedkar University, India) - Prenatal toxic metals exposure and risk of preterm birth : A study from AGRA region</p> <p>IP Al Richa Nasir (Tadulako University, Indonesia) - Assessing the risk of deltamethrin and cadmium (Cd) on terrestrial species tenebrio molitor as model test</p> <p>IP Sangki Choi (GIST, Korea) - Occurrence, removal and risk assessment of organic micropollutants in wastewater treatment plants in South Korea</p> <p>IP Nurullah Awal (WaterAid, Bangladesh) - Community engaged child faeces management (CFM) reduced disease outbreak : experience from WaterAid in Bangladesh</p> <p>IP Rajendra Prasad (Technology-Patent.Com, New Delhi) - The emerging concepts of sustainability and sustainable chemistry</p> <p>V Santona Khatun (ESDO, Bangladesh) - Detection of endocrine disruptors Bisphenol A and Bisphenol B in Bangladesh thermal receipt papers</p> <p>IP Jong-Un Lee (Chonnam National University, Korea) - Bioextraction of arsenic from polluted soil by Indigenous microbes and Shewanella putrefaciens</p> <p>IP Jinhee Park (IERI, GIST, Korea) - Providing safe drinking water through nanofiltration membrane water-purifying device to villages vulnerable to climate change in Laos</p> <p>IP Bidhan Chandra Pal (CUS, Dhaka) - Ecotourism and Bio-Diversity : South Asian Perspective</p> <p>IP Velayutham Murugesan (Annamalai University, India) - Environmental hazards of fluoride in drinking water : Health impact on children & adults and control measures</p> <p>IP Seungmo (Eric) Ku (Korea International School, Korea) - Development of Outing Indicators through Correlation Analysis between the COVID-19 Confirmed Cases and Particle Matter (PM) : Based on the Measurement Results of Outing Situation in Seongnam-City, Republic of Korea</p> <p>IP Dohyun Kim (NIER, Korea), IP Jihyon Kil (NIER, Korea) - WHO Collaborating Centre for Vulnerable Population and Environmental Health</p>
17:00 -	Student - Faculty Network Session

08:00 - 09:00	Registration
09:00 - 10:30	Plenary 3 : Health Effects of Plastics Exposure across the Life Span [Minderoo Foundation Session] Chair : V Sarah Dunlop (Minderoo Foundation)
	<p>V Sarah Dunlop (Minderoo Foundation) - Overview (5 mins)</p> <p>V Christos Symeonides (Minderoo Foundation) - Plastic chemicals and human health (18 mins)</p> <p>V Anne-Louise Ponsonby (Florey Institute) - The Barwon Infant Study - plastic chemical exposure during pregnancy and children's brain health (18 mins)</p> <p>IP Manuel Brunner (Minderoo Foundation) - Redesign and alternatives to plastics (18 mins)</p> <p>V Lizzie Fuller (Minderoo Foundation) - Plastics and chemical regulation (18 mins)</p> <p>IP/V Questions and discussion (10 mins)</p>
10:30 - 11:00	Break
11:00 - 12:30 (3 Parallel Sessions)	Symposium 7 : Microplastics Chair : V Fujio Kayama (Jichi Medical University, Japan) Co-chair : IP Ahmad Zaharin Aris (Universiti Putra, Malaysia)
	<p>Speakers</p> <p>IP Hasnawati Amqam (Hasanuddin University) - A number of microplastics detected in pregnant women's stool</p> <p>IP Ahmad Zaharin Aris (Universiti Putra, Malaysia) - The occurrence and potential sources of microplastics in the tropical coastal and estuarine ecosystems of Port Dickson and Klang River, Malaysia</p> <p>IP Khadija Al Nabhani (UNSW) - A temporal assessment of microplastics distribution on the beaches of three remote islands of the Yasawa Archipelago, Fiji</p>
11:00 - 12:30 (3 Parallel Sessions)	Symposium 8 : Environmental Impacts on Cancer Chair : V Satish Gopal (Director, NCI Center for Global Health)
	<p>Speakers</p> <p>V Satish Gopal (NCI, USA) : Opening Remarks – Pollution in Asia and health effects challenges</p> <p>V Roel Vermeulen (Utrecht University, The Netherlands) - State of the science in exposure assessment methods for indoor and outdoor air pollution in Asia</p> <p>IP Qing Lan (NCI, USA) - Household air pollution, epidemiology, genetic susceptibility, gene-environment interactions</p> <p>IP Nat Rothman (NCI, USA) - Molecular epidemiology and mechanistic studies of lung cancer among never-smokers in Asia</p> <p>V Chao A. Hsiung (NHRI, Taiwan) - Etiologic research on lung cancer including indoor and/or outdoor air pollution, risk prediction in nonsmoking women in Taiwan</p> <p>IP/V Zuofeng Zhang (UCLA, USA) - Studies of air pollution and health</p> <p>IP Kahung Chan (Oxford University, UK) - Indoor and outdoor air pollution and health effects in the China Kadoorie Biobank</p>



01 September 2022 DAY 4

	<p>IP Qing Lan, IP Nat Rothman (NCI, USA) - Closing Remarks - opportunities for research collaborations</p> <p>Symposium 9 : Nutrition Chair : V Antonio Pascale (University of Montevideo, Uruguay) Co-chair : IP Reni Suhelmi (Universitas Muhammadiyah Kalimantan, Timur)</p> <p>Speakers IP Bernhard Hennig (University of Kentucky, USA) - Nutritional Modulation of Environmental Toxicity and Implications in Inflammatory Diseases IP Md. Iqbal Hossain (ICDDR, B) - Identification and management of moderately and severely wasted under-five children, and risk factors of wasting among under-five children in Bangladesh : A systematic review IP Reni Suhelmi (Universitas Muhammadiyah Kalimantan, Timur) - Influences Analysis of Determinant Factors to helminthiasis and Nutritional Status in School Children thorough Sturctural Equation Modelling</p>
12:30 - 13:30	Lunch
13:30 - 15:00	<p>Plenary 4 : The Latest Issues in Climate Change and Their Solutions Chair : IP Suil Kang (IERI, GIST)</p> <p>Speakers Keynote Speaker : IP Young Joo Lee (CCOP) - CCOP's role to mitigate global climate change Mongolia : IP Bolorma Oyuntsetseg (National University of Mongolia) - Effect of soil properties and plant biomass on the health of przewalski's horses in Hustai National Park, Mongolia Vietnam : IP Le Thi Ha (NIOEH) - Medical Wastes generation Coeficients in Vietnam Cambodia : IP Seah Kah Yee (IERI, GIST) - Arsenic mass balance and its mobility in Mekong sub-region groundwater: case study of Kandal and Prey Veng province, Cambodia Thailand : IP Penradee Changpiwat (Chulalongkorn University) - Intergovernmental issue at Mekong river area Philippines : IP Mylene Gonzaga Cayetano (Universit of Phillipines Diliman) - Health Risk Assessment for Potentially Toxic Componants in the air and water media</p>
15:00 - 15:30	Break
15:30 - 17:00	<p>Plenary 5 : IERI and WHO CC for Vulnerable Population and Environmental Health Chair : IP Hyenmi Chung (National Institute of Environmental Research (NIER), Korea)</p> <p>IP Tak-soo Kim (NIER) - Study on the Characteristics of Health Monitoring of Humidifier Disinfectant Victims V Eun-Hee Ha (College of Medicine, Ewha Womans University) - Current Research Progress and Future Plans of KoCHENS (Korean Children's Environmental Health Study) IP Johanna Wegerdt, IP Jin Won Yi (WHO Asia-Pacific Centre for Environment and Health in the Western Pacific Region) - Climate Change in the Western Pacific Region IP Paul Jagal (WHO CC and CH&E) - Healthy environments for healthy children - broadening our mental mode</p>
18:00 -	Banquet

08:00 - 08:30	Registration
09:00 - 10:30	<p>Student Presentation Session Chair : IP Brittany Trottier</p> <p>09:00 - 09:18 IP M.M. Aeorangajab Al Hossain - Redistribution of potentially toxic elements in the hydrosphere after the relocation of a group of tanneries in Bangladesh</p> <p>09:18 - 09:36 IP Besral dan Evi Martha - Indonesian Adolescents Well-Being and Knowledge of Climate Change</p> <p>09:36 - 09:54 IP Chorney Eang - Chemical Upcycling of Polylactide (PLA) to Produce Electrospun Nanofibers wth Super-Hydrophobicity for Oil/Water Separation and Oil Absorption Applications</p> <p>09:54 - 10:12 IP Anh.T.P Hoang - Mitigation of arsenic accumulation in crop plants using biofertilizer</p> <p>10:12 - 10:30 V Himanshi Rohra - Exposure levels and toxicity implication of metal bound size-resolved PM in the Northern Indian Region</p>
10:30 - 11:00	Break
11:00 - 12:30	<p>Plenary 6 : Programs to Ensure Children's Wellbeing Chair : IP Peter Sly (University of Quennsland)</p> <p>Speakers V William Suk (NIEHS) - Collaborative Research: The e-Asia Program V Samantha Thomas (Deakin Uni, Aust) - Protecting Children from gambling V Andrea Hinwood (UNEP) - Environmental exposures in the Asia-Pacific region in a changing climate IP Paul Jagals (UQ, Aust) - Healthy environments for healthy children - broadening our mental models.</p>
12:30 - 13:30	Closing Ceremony and Awards
14:00 - 18:00	Field Trip



2022 PBC INVITED SPEAKER & MODERATORS

Akeem Ali

- Team coordinator, Head of office at Asia-Pacific Centre for Environment and Health, World Health Organization (WHO)

Youn-Joo An

- Professor, Dean of the College of Sang-Huh Life Science at Konkuk university
- Members of Soil pollution Risk assessment expert committee, Ministry of Environment

Hyun Sik Chang

- Adjunct Professor of Department of Social Welfare at Ewha Womans University

Hana Cho

- Senior Research Fellow, Korea Adaptation Center for Climate Change, Korea Environment Institute (KEI)

Hyenmi Chung

- Director General of Environmental Health Research Department, National Institute of Environmental Research (NIER)
- WHO CC for Vulnerable Population and Environmental Health

Stephanie Cormier

- Associate Vice President of the office of Research and Economic Development at the Louisiana State University
- Chair of the Pacific Basin Consortium for Environment and Health

Sarah Dunlop

- Emeritus Professor, Director of Plastics and Human Health at Minderoo Foundation

Satish Gopal

- Director of Center for Global Health, National Cancer Institute (NCI)
- Associate professor at the University of Malawi College of Medicine

Eun-Hee Ha

- Professor of College of Medicine at Ewha Womans University

Budi Haryanto

- Professor at the Department of Environmental Health & Research Center for Climate Change, University of Indonesia
- Board member of the Pacific Basin Consortium for Environment and Health

Michelle Heacock

- Health Science Administrator, Superfund Research Program, National Institute of Environmental Health Sciences (NIEHS)

Andrea Hinwood

- Chief Scientist, UN environment programme (UNEP)

Zahir Islam

- Clinical Research Fellow at the Child Health Research Centre, the University of Queensland

Paul Jagals

- Professor at the University of Queensland
- Direct, WHOCC and CH&E at the Child Health Research Centre, Faculty of Medicine

Suil Kang

- Chief Supervisor, International Environmental Research Institute (IERI), Gwangju Institute of Science and Technology (GIST)

Fujio Kayama

- Professor of School of Medicine, Jichi Medical University
- Emeritus of the Pacific Basin Consortium for Environment and Health

Hyun Kim

- Associate professor of the Division of Environmental Health Sciences at University of Minnesota
- WHO Climate Change Project Coordinator

Kyoung-Woong Kim

- Professor of School of Environmental Science and Engineering at Gwangju Institute of Science and Technology (GIST)
- Director of International Environmental Research Institute (IERI)
- Board member of the Pacific Basin Consortium for Environment and Health
- PBC 2022 conference president

Tak-soo Kim

- Senior researcher of Humidifier Disinfectant Health Center, Environmental Health Research Department, National Institute of Environmental Research (NIER)



Colleen Lau

- Professor at the University of Queensland
- Professional Research Fellow at the school of Public Health, Faculty of Medicine
- Board member of the Pacific Basin Consortium for Environment and Health

Young Joo Lee

- Director, CCOP Technical Secretariat

Diana (Dee) Lewis

- Assistant professor at University of Guelph
- Board member of the Pacific Basin Consortium for Environment and Health

Antonio Pasclae

- Adjunct Professor of Clinical Toxicology at the Department of Toxicology, School of Medicine, University of the Republic, in Montevideo
- Vice Chair of the Pacific Basin Consortium for Environment and Health

Rajendra Prasad

- Director, MERIT INDIA CO.
- Patent Consultant

Lunchakorn Prathumratana

- Project manager, EU SWITCH-ASIA SCP Facility at Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Tahir Rafique

- Senior Scientific Officer at Ministry of Science & Technology, PCSIR Laboratories Complex

Rengaraj Selvaraj

- Assistant Professor at Department of Chemistry College of Science Sultan Qaboos University

Peter Sly

- Professor at the University of Queensland
- NHMRC Leadership Fellow at the Child Health Research Centre, Faculty of Medicine
- Emeritus of the Pacific Basin Consortium for Environment and Health

William Suk

- Director of Center for Risk and Integrated Sciences (CRIS)
- Branch chief of the Hazardous Substance Research Branch in the National Institute of Environmental Health Sciences (NIEHS)

Samantha Thomas

- Professor of School of Health & Social Development at Deakin University

Brittany Trottier

- Health Specialist, Superfund Research Program, National Institute of Environmental Health Sciences (NIEHS)

Dwan Vilcins

- Environmental Scientist, at the Child Health Research Centre, Faculty of Medicine, the University of Queensland
- Junior Advisory of the Pacific Basin Consortium for Environment and Health

Johanna Wegerdt

- WHO WPRO Climate Change Technical Officer
- WHO Asia-Pacific Centre for Environment and Health in the Western Pacific Region

Ayaho Yamamoto

- Postdoctoral Research Fellow of Child Health Research Centre at the University of Queensland

Jln Won Yi

- WHO Asia-Pacific Centre for Environment and Health in the Western Pacific Region



TRAINING WORKSHOP I

This workshop offers a refresher on understanding some of the practical risk impact assessment methods – from the most basic to a more complex integration of risk and impact assessment.

DATE & TIME 14:00 - 15:30, 29 August, 2022

VENUE Crystal A, Maison Glad Hotel, Jeju Island, South Korea

13:30 - 14:00(25 + 5 min)

Paul Jagals, University of Queensland

14:00 - 14:30(25 + 5 min)

Colleen Lau, University of Queensland [Virtual presentation]

14:30 - 15:00(25 + 5 min)

Dee Lewis University of Guelph, Canada [Virtual presentation]

Integrated Environment Health Risk And Impact Assessment

TRAINING WORKSHOP II

In general, children receive a higher “dose” of toxicants in a given environment, are less able to neutralize toxicants and live long enough for diseases with long latency periods to manifest. This workshop will cover the principles underlying the vulnerability of children and will highlight risks in specific environments. This workshop is part of a series organised by staff from the Network of WHO Collaborating Centres for Children's Environmental Health at previous PBC conferences. This workshop provides an opportunity for engagement of a wider audience and additional training with evaluation materials made available to trainees.

DATE & TIME 14:00 - 15:30, 29 August, 2022

VENUE Crystal B, Maison Glad Hotel, Jeju Island, South Korea

13:30 - 14:00(25 + 5 min)

Peter Sly, University of Queensland -
Vulnerability of Children to environmental exposures

14:00 - 14:30(25 + 5 min)

Stephania Cormier, Louisiana State University -
Air Pollution and Children's Health

14:30 - 15:00(25 + 5 min)

Antonio Pascale, University of the Republic -
Impacts of pesticide exposure in childhood

Children's Environmental Health



TRAINING WORKSHOP III

Each region of the planet faces various challenges, and multi-level collaborations are being made to solve them. The two major efforts promoted through the UN are responding to climate change and achieving the Sustainable Development Goals (SDGs). In this workshop, participants will have an opportunity to learn on the ways for the regional collaboration and what the priority actions for regional collaboration in climate change response, especially in the field of adaptation, and achieving the SDGs.

CO-ORGANIZERS

- International Environmental Research Institute (IERI), Gwangju Institute of Science and Technology (GIST)
- Jeju-International Development Cooperation Center (IDCC)

DATE & TIME 12:00 - 13:30, 29 August, 2022

VENUE Crystal B, Maison Glad Hotel, Jeju Island, South Korea

12:00 - 12:05(5 mins)

Opening Remarks and Introduction to the Workshop

Prof. Kyoung-Woong KIM

Director of International Environmental Research Institute Professor of Gwangju Institute of Science and Technology

12:05 - 12:30(20 + 5 mins including Q&A)

Korea's ODA & SDGs : Climate Change

Dr. Hyun Sik CHANG - Professor of Social Welfare Ewha Woman's University

12:30 - 12:55(20+5 mins including Q&A)

Strengthening Endogenous Capacities and Technologies

Dr. Suil KANG - Chief Supervisor International Environmental Research Institute (IERI), Gwangju Institute of Science and Technology (GIST)

12:55 - 13:20(20+5 mins including Q&A)

Climate Change Impacts and Adaptation

Dr. Hanna CHO - Senior Research Fellow, Climate and Air Research Group, Korea Adaptation Center for Climate Change Korea Environment Institute (KEI)

13:20 - 13:30 Closing Remarks

Identification Of Priority Actions For Regional Collaboration

Coordinator- Dr. Suil Kang (IERI/GIST)

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Rajamani

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Strengthening endogenous capacities and technologies

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Pre-conference Training Workshop

In response to a request the Conference of Parties (COP) to the UNFCCC made at its twenty-first session, the UNFCCC Technology Executive Committee (TEC) undertook work on the development and enhancement of countries' endogenous capacities and technologies. The TEC conducted surveys of relevant stakeholders and experts from to gain insight into their views on the elements and features that could be used to describe, develop and enhance endogenous capacities and technologies. With regard to defining endogenous capacities, the respondents, especially the NDEs, put strong emphasis on the capacity to: Assess climate-related technology needs from the individual to the national levels; Identify appropriate technologies to assist in meeting identified needs; Adapt technologies to local needs and conditions. With regard to defining endogenous technologies, the following features were highlighted by the respondents: Technologies developed within the country or by a team of in-country and external people; Technologies developed elsewhere but adapted to local needs and conditions. The TEC also elaborated a wide range of strategies can be used to create enabling environments for enhancing countries' capacities to develop endogenous technologies, including collaboration, financing and building technical skills. Those results will be presented to provide ways to strengthen endogenous capacities for the development of new climate technologies and modification of existing climate technologies.

Impacts of pesticide exposure in childhood

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Pre-conference Training Workshop

A wide variety of different formulations and concentrations of pesticides are used in different settings: agriculture, animal sanitary bath, domestic use, and vector control. Lack of awareness, poor agricultural practices, and inappropriate disposal of containers increase the risk of exposure and toxicity. A critical window of susceptibility for children represents their prenatal period to infancy. Pesticide related diseases may be diagnosed during infancy, adolescence, or adulthood. Children may be exposed by multiple routes of exposure, in different scenarios. In domestic settings, insecticides and rodenticides are usually stored within the reach of children, or may be transferred to non-original containers, leading to acute non intentional ingestion. Exploratory behavior increases the risk for exposure to pesticides present on the ground. Gardens and playgrounds may have pesticides residues. Children may be in contact with domestic animals that have been treated with pesticides. In rural settings, children can be exposed to pesticide residues in areas where they have been applied, or by contamination of work equipment and parents clothing. Families dedicated to rural activity have higher levels of exposure, through ingesting contaminated food and water. Several studies confirmed pesticide exposure in children by biomonitoring. Higher levels of organophosphate metabolites have been reported in children compared to adult populations. Toxic effects of pesticides depend on their intrinsic toxic properties as well as on the dose, duration, and life period of exposure. Acute poisonings are related to high doses exposure, while chronic, subtle, and delayed effects are often related to low levels/ doses exposure. Epidemiologic, animal, and clinical studies suggest an association between chronic, low-level exposures and alterations in growth and development (particularly impaired neurobehavioral development), cancer and increased susceptibility to infections. Emerging research presents evidence that some pesticides are a risk factor of a wide range of acute and chronic diseases. Better practices and public health policies are needed to prevent and protect children from pesticides exposure.

KEYWORDS children; diseases; exposure; pesticides; poisoning



Lunchakorn PRATHUMRATANA

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)

Per Blomqvist • Ola Willstrand • Jonna Hynnen

RISE Research Institutes of Sweden

Climate policies in tackling climate change

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 1: Environmental exposures in the Asia-Pacific region in a changing climate

Climate change is a global problem that requires international cooperation to address. The threat of climate change is being addressed globally by the United Nations Framework Convention on Climate Change (UNFCCC): the long-term objective is 'to stabilize atmospheric greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. The science clarifies how much more needs to be done to effectively tackle dangerous climate change from impacting the planet and its people. The author summarises the efforts to solve climate change issues through policies, instruments and measures that are being implemented at the global, regional, and national levels.

Emissions from electric vehicle fires

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 1: New trends in air pollution

The ongoing shift to electromobility has identified new risk areas including the release of toxic gas from burning lithium-ion batteries. Especially the emission of HF from combustion of the battery electrolyte has given concern. Information on the emission from vehicle fires is limited and information regarding emissions from battery electrical vehicles (BEV) is even scarcer.

To thoroughly investigate the emission from fires with BEV and compare with that from internal combustion engine vehicles (ICEV), the ETOX-1 project was conducted by RISE in 2020 [1]. Full-scale fire tests were conducted with one ICEV and two BEV. Analysis was focused on emission to the atmosphere and included analysis of both inorganic compounds (including HF), PAHs, and metals. In addition, tests were made with batteries from cell up to pack-size to study correlation for tests of different sizes. Further, results of the tests were used for modelling of gas spread and toxic effect in a hypothetical vehicle fire in a parking garage.

ETOX-2 was launched in 2021. Full-scale tests were conducted in early 2022 with three vehicles and a complete battery pack, and sprinklers were here applied to investigate the contaminant distribution between gas phase and water. The analysis program was like that of ETOX-1, but water analysis was added.

The results from the full-scale vehicle fire tests in ETOX-1 showed that hydrogen fluoride together with some specific metals, e.g., Ni, Co, Li and Mn in the fire effluents constitute a large difference between electrical and conventional vehicles. The ETOX-2 study preliminary shows that the general production pattern seen in ETOX-1 also was seen here, and that there was a clear effect of the sprinklers on the amounts of toxicants emitted to gas phase which were recovered in sprinkler water run-off. Both projects were financed by the Swedish Energy Agency.

[1] Ola Willstrand et al., Toxic Gases from Fire in Electric Vehicles, RISE report 2020:90, diva2 : 1522149



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Exposures to fine particulate matter (PM_{2.5}) and its effects on pre-term birth and related outcomes

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 1: New trends in air pollution

The exposure to atmospheric fine particles (aerodynamic diameter < 2.5 µm, referred to PM_{2.5}) is playing a vital role for adverse human health problems as well as regional climate change. It is known that several atmospheric particles/aerosols produce reactive oxygen species (ROS) in situ and its production causes imbalance between oxidants and antioxidants in the human body. Maternal exposure to PM_{2.5} concentrations has also been identified as a risk factor for preterm birth and related outcomes (low birth weight). A yearlong study has been conducted to examine the association between PM_{2.5} and pre-term birth and related outcomes at Agra region of India. PM_{2.5} concentration was 102±62 µg m⁻³ varied from 218 µg m⁻³ (maximum) and 33 µg m⁻³ (minimum). It was observed that 42 % cases were found as pre-term birth while 58% cases were observed for full-term birth. Apart from this, it also inferred that 30% normal birth weight (NBW) were observed while 70 % were responsible for low birth weight (LWB) in preterm birth studies. The average birth weight varied from 2150±180gms (LBW) to 2910±330 gms (NBW). The ratio of GSH and MDA (GSH/MDA) was found to be double for full-term (2.036) cases as compared to pre-term (1.048) indicating ROS production which is clearly indicated environmental exposure (PM_{2.5}) is one of the major factors towards LBW cases. Statistical analysis revealed inverse relationship between PM_{2.5} and birth outcomes (slope: - 0.042, intercept: 218.64) as PM_{2.5} increase, birth weight decreases during maternal exposure. The environmental exposure to PM_{2.5} was responsible for related birth outcomes along with adverse health effects during the maternal period.

Changes in fire weather climatology under warmer climate

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 1: New trends in air pollution

The 2015 Paris Agreement led to a number of studies that assessed the impact of the 1.5 °C and 2.0 °C increases in global temperature over preindustrial levels. However, those assessments have not actively investigated the impact of these levels of warming on fire weather. In view of a recent series of high-profile wildfire events worldwide, we assess fire weather sensitivity based on a set of multi-model large ensemble climate simulations for these low-emission scenarios. The results indicate that the half degree difference between these two thresholds may lead to a significantly increased hazard of wildfire in certain parts of the world, particularly the Amazon, African savanna and Mediterranean. Although further experiments with human land use are needed to depict future fire activity, considering that rising temperatures are the most influential factor in augmenting the danger of fire weather, limiting global warming to 1.5 °C would alleviate some risk in these parts of the world.



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Resistomap Oy, Finland

Laboratory service for monitoring antibiotic resistance genes and pathogens in water environments

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 2 : Water

The United Nations Environment Program (UNEP) identified antibiotic resistance in the environment as one of its top six emerging issues of environmental concern with global implications in its Frontiers 2017 report. Huge, global need for monitoring of antibiotic-resistant bacteria and their antibiotic resistance genes (ARGs) in the environment is emerging. Therefore, Resistomap Oy, a biotechnology company registered in Helsinki, Finland comes in to enable researchers from universities, research institutes, hospitals, water utilities, and primary food productions to monitor the ARGs and genes associated with pathogens in the environment by providing an end-to-end laboratory service with personalized analysis and interactive report of ARG profiles. Resistomap team has over 10 years of experience and know how knowledge to monitor antibiotic resistance from environmental samples using high-throughput SmartChip quantitative Polymer Chain Reaction (qPCR) technology (Takara Bio). We are the front runner commercial laboratory service by combining molecular genetics and data science for a fast and comprehensive monitoring of antibiotic resistance and pathogens in any environment including rivers and lakes, sediment, wastewater, and seawater samples. From 2019, Resistomap have served over 170 projects, and analyzed over 5000 environmental samples across 38 countries. Resistomap goals is to map environmental resistomes across the globe for understanding the development and spread of antibiotic resistance and pathogens in the environment.

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Development of method for estimating chemical emissions to the water environment from occupational use of consumer chemical products

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 2 : Water

Chemical substances in consumer chemical products (CCPs) can be discharged into the water environment by the use of CCPs at home or at work. The objectives of this research were 1) to develop a method for estimating the CCPs usage and the chemical emissions to the water environment by occupational use, and 2) to suggest the chemical emission factor that considers the chemical behaviors until they reach domestic sewage treatment plants.

This research defined the occupational users of CCPs, and 10 items with the possibility of water discharge were selected. In order to calculate the regional usage (or emissions) by occupational users, we constructed the nationwide business information by the category. The business information was obtained by data crawling from portal site map service or from the government website. The amount of CCPs used was investigated through a questionnaire survey, which is used to derive the emission unit of CCP by category in business. Based on the suggested emission unit, the usage and emission of CCPs can be calculated for whole category in business. Finally, the emission factor for each chemical substance containing CCPs can be determined by considering the chemical content in CCPs and the removal rate of each chemical in sewers.

About 7 million company information was established nationwide. Representative categories of business were selected, and calculating the emission unit of CCPs is ongoing based on the result of questionnaire survey. The nationwide business information will be supplemented through additional crawling and data deduplication. A database management system will be introduced and managed in the future. The results of this study such as usage, emission, and emission unit will be visualized and provided using a GIS model.

In order to increase the reliability and accuracy of the results, it is necessary to update the business information regularly, and to supplement the emission unit of each industry by expanding the survey in the future. By presenting a methodology that can be considered for occupational use, this study provides the foundation for evaluating the overall environmental impact of CCPs.



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Machine learning for flood prediction in Indonesia : providing online access for disaster management control

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 2 : Water

Climate change has altered the hydrological cycle which leads to unpredictable and extreme precipitation events, triggering a high risk of flooding across the globe. As one of the most vulnerable countries to floods, there should be a high necessity for accurate and reliable flood forecasting in Indonesia. In a megacity such as Jakarta, several proper flood forecasting methods are already available; however, the rest of the Indonesian regions are left behind. The current flood forecasting provided by the Indonesian government is on a monthly basis and made of monthly forecasts of precipitation and flood-prone area maps without mathematical or statistical analysis. The sample of current forecast from the last 3 years was evaluated and resulted in hundreds of wrong predictions. Therefore, a new prediction model using a machine learning algorithm is proposed to provide daily flood prediction in Indonesia, which consists of 33 regions. Data crawling was conducted to obtain daily precipitation, streamflow, land cover, and flood data for the last 13 years, from 2008 to 2021. The model was built using Random Forest (RF) algorithm for classification. The accuracy, specificity, precision, recall, and f1-score of the prediction model using the RF algorithm are approximately 99.91%, 99.90%, 99.47%, 99.99%, and 99.72%, respectively. Moreover, the AUC (Area Under the Curve) of the ROC (Receiver Operating Characteristics) curve results in 99.97% and an OOB (Out of Bag) error of < 0.001. The Partial Dependence Plots (PDP) indicate that flood in Indonesia is highly dependent on precipitation rate value. Furthermore, the variable importance plot shows the most to the least important variables, which are precipitation rate, forest ratio, and streamflow. Both the PDP and variable importance suggest that the vast majority of occurred flood events are flash flooding and only a few coastal, riverine, or other types of flooding in Indonesia. The precipitation forecast for June 2022 was gathered and input into the model, resulting in the flood prediction. Flood prediction for June 2022 was then deployed as an open-access website using shinyR. This flood prediction model is a fast and accurate alternative to complement the current flood forecast with extensive information.

Biological synthesis of inorganic nanomaterials using microorganisms

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 2 : Water

Climate change has altered the hydrological cycle which leads to unpredictable and extreme precipitation events, triggering a high risk of flooding across the globe. As one of the most vulnerable countries to floods, there should be a high necessity for accurate and reliable flood forecasting in Indonesia. In a megacity such as Jakarta, several proper flood forecasting methods are already available; however, the rest of the Indonesian regions are left behind. The current flood forecasting provided by the Indonesian government is on a monthly basis and made of monthly forecasts of precipitation and flood-prone area maps without mathematical or statistical analysis. The sample of current forecast from the last 3 years was evaluated and resulted in hundreds of wrong predictions. Therefore, a new prediction model using a machine learning algorithm is proposed to provide daily flood prediction in Indonesia, which consists of 33 regions. Data crawling was conducted to obtain daily precipitation, streamflow, land cover, and flood data for the last 13 years, from 2008 to 2021. The model was built using Random Forest (RF) algorithm for classification. The accuracy, specificity, precision, recall, and f1-score of the prediction model using the RF algorithm are approximately 99.91%, 99.90%, 99.47%, 99.99%, and 99.72%, respectively. Moreover, the AUC (Area Under the Curve) of the ROC (Receiver Operating Characteristics) curve results in 99.97% and an OOB (Out of Bag) error of < 0.001. The Partial Dependence Plots (PDP) indicate that flood in Indonesia is highly dependent on precipitation rate value. Furthermore, the variable importance plot shows the most to the least important variables, which are precipitation rate, forest ratio, and streamflow. Both the PDP and variable importance suggest that the vast majority of occurred flood events are flash flooding and only a few coastal, riverine, or other types of flooding in Indonesia. The precipitation forecast for June 2022 was gathered and input into the model, resulting in the flood prediction. Flood prediction for June 2022 was then deployed as an open-access website using shinyR. This flood prediction model is a fast and accurate alternative to complement the current flood forecast with extensive information.



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Effects of temperature on soil geochemical properties and heavy metals accumulation in *Brassica Napus L.*

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 3 : Heavy metals

According to the Inter-Governmental Panel on Climate Change (IPCC, 2021), the earth has been warmed 1.09°C since the pre-industrial era, and global surface temperature is likely to be higher by 1.0°C to 5.7°C by the end of the twenty-first century (2081-2100). However, the effects of increased temperature on soil properties and heavy metal uptake of plants have not been known well. In order to investigate the effects of soil temperature on soil geochemical properties and the metal uptake of plants, we grew rapeseeds (*Brassica napus L.*) in pots filled with contaminated field soil at 4 different temperatures (22.5, 22.9, 23.7, and 24.6°C) in controlled growth chambers. The results showed that elevated temperature inhibited the growth of rapeseed, and the seed yields decreased by 37 % at 24.6°C compared to 22.5°C. In the case of heavy metal uptake, the values of partial correlation coefficient controlling the growth stage followed this order: Zn (0.50) > Cd (0.21) > Cu (0.19) > As (0.15) > Pb (0.13). Zinc concentration in rapeseed showed a significant moderate positive correlation with soil temperature ($r=0.50$). Furthermore, Zn and Cd concentrations in plants were highly correlated during all growth stages, with a high positive correlation ($r > 0.7$). It indicates that if the soil is heavily contaminated with Cd, increase in soil temperature could affect the accumulation of Cd in plant tissues. In total and bioavailable heavy metal concentrations in soil, no significant variations were observed with soil temperature. When controlling the time of sample variables, soil pH was positively correlated with soil temperature, whereas electrical conductivity (EC) and cation exchange capacity (CEC) were negatively correlated with soil temperature. These findings suggest that elevated soil temperature affected plant processes and soil geochemical properties that induced loss of productivity and soil-to-plant transfer of Zn and Cd. It shows that future global warming may lead to unforeseen losses in crop productivity and quality and consequently it may have detrimental effects on health for animals and human beings.

Prenatal exposure to polycyclic aromatic hydrocarbons(PAHs) and birth size

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 4 : Emerging and re-emerging infectious diseases

Earlier researches have shown association between prenatal environmental exposures specifically to polycyclic aromatic hydrocarbons (PAHs) and adverse health outcomes; however inconsistency lies in reported results and limited focus on women from developing nation India, which is ranked first for preterm birth. Thus, there is a mounting need to assess the presence of PAHs in human tissues and its further impact on adverse neonatal outcomes. In present study 120 placenta tissue samples were collected immediately after delivery from North Indian pregnant women followed by quantification of PAHs with the help of GC-MS. A well structured questionnaire enclosing socio-demographic characteristics of women and sources of environmental and occupational exposures to PAHs were filled by researchers via face to face interviews. Indeno (123cd) Pyrene (24.4%), benzo(a)pyrene (19.03%) and chrysene (13.85%) were the most dominant PAHs detected, among all measured PAHs. In addition, high molecular weight PAHs were found to be in more prevalence in placenta tissue samples than low molecular weight congeners. Results of student's t-test indicated that most PAHs (except acenaphthylene) were higher in mothers delivering low birth weight infants (LBW<2500 gm) with significantly higher levels of fluorene, fluoranthene, pyrene and benzo(k)fluoranthene than normal birth weight infants (NBW≥2500 gm). For birth weight, there was a significant decrease of 0.36 and 0.25 units with unit increase of benzo(b)fluoranthene and benzo(ghi)perylene (BgHiP) respectively. A significant decrease of 0.26 unit ($p<0.05$) in birth length and 0.15 units ($p=0.05$) in head circumference was found for unit increase in benzo(ghi)perylene and pyrene respectively although no significant association was found for PAHs with ponderal index and cephalization index. These results reveal that in-utero exposure to some PAHs could impair the anthropometric development of the fetus, reducing birth weight and length. As neonatal anthropometric measures are considered as an important tool to identify newborns at higher risks of morbidity and impaired fetal growth. Thus, it is an urgent need of hour to lessen exposure of harmful contaminants to child bearing population and to evaluate maternal PAHs exposure in relation to long term impact on infant health.



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Remediation of mercury contaminated sensitive site and soil by adopting unique two stage process of water wash and retard

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 4 : Emerging and re-emerging infectious diseases

A unique remediation process for mercury contaminated site in a sensitive residential-cum-tourist location has been developed for ensuring environmental protection. The leachate of mercury from thermometer manufacturing process caused soil pollution, occupational health issues such as respiratory and urinal problems. This resulted in the closure of the entire manufacturing facility and directions from environmental protection authorities for remediation in a land area of more than 40000m². The procedures, protocols and standards have been developed for remediation of mercury polluted soil surrounded by trees and plantation in a sloped area. The contamination of Hg ranges from 100 to 400mg/kg of soil and has to be remediated to the prescribed standard of less than 20mg/kg.

The remediation process started with detailed environment impact assessment study on the levels of mercury contamination inside the factory and the entire surroundings of more than 5km radius and water stream leading to the reservoir for a distance of about 30km. Development of suitable remediation process of more than 10000 tons of contaminated soil around the thermometer factory without causing damage to the tall trees and plantations in slope terrain is a major challenge. After detailed study, research and developments with lab and pilot scale remediation studies, a two-stage process of water wash and retard systems were designed and implemented for remediation. The contaminated soil was taken in batches for remediation process by making contour trenches and the area is controlled by providing silt traps and retaining walls. The remediated soil after two stage treatment process with less than 20mg/kg is amended with nutrients and refilled in the trenches.

The recovered highly concentrated hazardous category mercury from the contaminated soil is to be further concealed by adopting solidification process. After solidification, the hazardous category sludge is taken to the exclusive cells developed with water tight Reinforced Cement Concrete structures and High Density Poly Ethylene liners. The remediation program with the involvement of many national and international scientists and experts from multidisciplinary field is under final stage of implementation with a huge investment of nearly 50 million US Dollars which is first of its kind in Asia.

KEYWORDS Hazardous waste, Remediation, Mercury pollution, Environmental health.

Climate change and emerging and re-emerging mosquito-borne viruses

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 5 : Emerging and re-emerging infectious diseases

Vector-borne diseases continue to represent significant public health threats of the 21st century. Mosquito-borne viruses especially threaten the health and vitality of populations around the globe. Emerging and re-emerging viruses that are transmitted by mosquitoes have accounted for major outbreaks in the last decade alone: dengue, yellow fever, Zika, and chikungunya. And there continues to be pockets of transmission of West Nile virus, Ross River virus, and a recent emergence of Japanese Encephalitis in Australia. The geographical distribution of vector species necessarily defines the risk for associated viruses, which is itself dependent on thermal and climatic suitability. Our current assessments of who and where is at-risk will become inadequate if we cannot holistically account for the multitude of factors that climate change will alter. Weather patterns including significant storm events not only affect mosquito population dynamics, but contact patterns with susceptible hosts. Changing temperature patterns lead to geographic expansions of vector distributions both in space and time. Here I discuss some of the results from both experimental and modeling studies that demonstrate how climate change will alter who is at-risk for mosquito-borne viruses and discuss how One Health approaches can lead to holistic and efficient solutions.



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Using mosquitoes for surveillance of vector-borne diseases

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Symposium 5 : Emerging and re-emerging infectious diseases

Surveillance and monitoring are crucial components of Neglected Tropical Disease elimination programs, required for both estimating infection prevalence in humans **1** and detecting residual transmission **2,3**. Many surveillance programs rely on blood samples from the human population, which are tested for the presence of an indicator such as antigen, antibodies or microfilaria. While results from serosurveys are the most direct indicator of infection in humans, there are logistic issues with finding and enrolling participants, and gaps in our understanding of how long antigen and antibodies persist post-infection **4**.

For vector-borne diseases, such as lymphatic filariasis (LF), molecular xenomonitoring (MX) of mosquitos can complement human surveillance. Mosquitoes can be trapped at a location over a period of hours or days, and are tested in batches using Polymerase chain reaction (PCR) analysis. This tests for the presence of the parasite DNA in the mosquitoes and returns a positive result if any DNA is detected (i.e. if any mosquito in the batch was infected). From these data, specialised software packages can be used to estimate the overall infection prevalence in the mosquitoes⁵. Whereas the presence of antigen or antibodies from human blood samples can indicate either a current or past infection, the short lifespan (less than a month) and short flight range (a few hundred meters) of mosquitoes means that PCR-positive samples are indicative of currently infectious humans nearby.

In this presentation, we describe results from our field studies in Samoa providing preliminary evidence that MX is potentially more sensitive than antigen for detecting changes in prevalence following interventions such as mass drug administration. Despite the advantages, there still are some gaps in our knowledge of appropriate MX survey design, such as the value of sorting mosquitoes into vector and non-vector species, optimal batch sizes for mosquito pools, and how closely prevalence in mosquitos correlates with prevalence in humans. Our current work in this space includes geospatial modelling of the relationship between human and MX surveys, a cost-benefit analysis to evaluate optimal pooling strategies for batch sizes, and developing a user-friendly interface for our PoolTestR package for estimating prevalence of pooled samples.

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Is the existence of breeding places and cattle pens a risk factor for the incidence of filariasis in Indonesia?

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 5 : Emerging and re-emerging infectious diseases

Filariasis is a neglected tropical disease which is still a health problem because it can cause disability and paralysis and there are 9,839 chronic cases recorded in Indonesia. This study aims to analyze the existence of breeding places and livestock pens as a risk factor for filariasis transmission.

We performed a case-control design of 23 patients who were positive for microfilariae based on the results of the Filariasis Finger Blood Survey and 46 controls were people who were negative for microfilariae out on Doang-Doangan Caddi Island and Bangko-Bangkoan Island, Pangkep Regency. Data analysis using Stata Program with Odds Ratio (OR) test and 95% confidence interval [CI].

Case group had more breeding places (82.6%) than the control group (26.1%). Residents whose homes have breeding places have a OR 13.45 (95% CI, 3,388 to 62,7125). The existence of cattle pens, respondents who do not have cattle pens in the case group are the same as those in the control group were 78.3%. The results of the analysis for the variable presence of cattle pens obtained the value of OR 1; (95% CI, 0,232-3,825). This shows that the existence of breeding places and the incidence of filariasis, which means that people who live around their homes are at risk of developing filariasis. Stagnant water is a place with a higher density of mosquito breeding than other breeding places and the distance of these breeding places is very close to the location where people live.

Breeding places is strongly associated with filariasis than presence of cattle pens, Future research should include other factors that allow filariasis to occur to validate this research.

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Environmental factors associated with lymphatic filariasis infection in American Samoa : an analysis to enhance current surveillance and elimination strategies

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 5 : Emerging and re-emerging infectious diseases

Background : Due to a successful elimination program, lymphatic filariasis (LF) has been reduced to low-level prevalence within American Samoa. Following seven rounds of mass drug administration between 2000-2006, transmission assessment surveys (TAS) found that American Samoa had levels of LF that made future transmission unlikely. Unfortunately, re-emergence was detected in 2016, when both TAS-3 and a community survey found the prevalence of multiple LF infection markers above what it had been for TAS-1 and TAS-2, indicating that previous surveys may have missed areas of ongoing transmission. This study aimed to identify potential environmental drivers of LF to refine future surveillance efforts.

Method : Data on five LF infection markers : antigen, Wb123, Bm14 and Bm33 antibodies and microfilaraemia, were obtained from a population-wide serosurvey conducted in American Samoa in 2016. Data on eleven environmental factors were derived from multiple freely available sources. Separate multivariable Poisson regression models were developed for each infection marker to assess and quantify the associations between LF infection markers and environmental variables.

Results : Rangeland cover, tree cover and urban cover were consistently associated with an increased positivity of LF-infection markers, but to varying magnitudes between the landcover classes. High slope gradient, population density and crop cover had a negative association with the presence of LF infection markers. An association between rainfall and LF infection markers was not detected, possibly due to the lack of variation in rainfall across the island.

Conclusion : This study demonstrated that LF infection markers are more consistently associated with topographical environmental variables, such as slope gradient, rather than climatic variables, such as rainfall. These results provide the initial groundwork to support the detection of at-risk areas and LF elimination efforts through an understanding of the environmental drivers.



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Radionuclide (cesium) behavior in various clays of decommissioning site of nuclear facilities : batch, XRD, and EXAFS techniques

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 5 : Emerging and re-emerging infectious diseases

The analysis and prediction for radioactive contamination of decommissioning site is very important to reduce the cost and time in decommissioning of the nuclear facilities. Chemical bonding structure between soil and radionuclides determines the mobility and bioavailability of radionuclides in a natural environment and is known as an important factor influencing adsorption and desorption. Cesium (Cs) adsorption and desorption behavior of illite, hydrobatite, and montmorillonite clays were examined through Cs adsorption, NaCl, oxalic desorption, XRD, and X-ray Absorption Fine Structure (XAFS). Montmorillonite was the highest in Cs adsorption maximum in isotherm test among three clays, however, illite was the highest in selective adsorption in low Cs concentration, indicating the high selectivity due the Frayed Edge Site (FES). In NaCl desorption, montmorillonite was found to be the lowest for Cs desorption efficiency. The desorption rate of hydrobatite was highest by oxalic acid.

Based on the EXAFS analysis, Cs outer sphere and inner sphere complexes appeared in Cs adsorption of clay. Inner sphere complexes in illite and montmorillonite mainly appeared in NaCl desorption, indicating for Cs chemical bonding in FES. XRD analysis revealed that the layer distance of illite and hydrobatite expanded, but the layer distance of montmorillonite decreased after NaCl desorption, indicating the prevention of Cs ion from interlayer of montmorillonite. Through this study, adsorption characteristics, interlayer distance, characteristics of Cs inner sphere, and outer sphere complexes were different for each clay. Therefore, this will be used as the data for the behavior of Cs in decommissioning site of nuclear facilities. Further study will conduct the development for the prediction model based on the data for binding structure between clay and radionuclides in decommissioning site of nuclear facilities.

Green 2D nanostructured materials for the degradation of hazardous waste present in water and wastewater

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 6 : Hazardous waste remediation

The quality of water resources is deteriorating day by day due to the continuous addition of undesirable hazardous waste and chemicals to the environment. The deleterious effects of chemicals on the earth's ecosystems are a cause for serious concern. Several of these chemicals, such as pesticides, dyes, pharmaceuticals, NOMs, PCPs, POPs are actually present in ground water, rivers and lakes, and are in part suspected of being endocrine-disrupting chemicals (EDCs). Although, it is still being discussed whether such chemicals have an influence upon human beings or not, it is necessary to develop efficient techniques for the removal of those EDCs from water and wastewater as soon as possible. Nanotechnology is one of the most promising methods for the degradation of such EDCs presented in water and wastewater under solar energy. In this study, we have developed a graphite-like 2D carbon nitride (g-C₃N₄) nanosheet in our lab by simple direct heating thermal oxidation etching process at 550 °C for 12 h. The prepared 2D nanostructured photocatalysts were characterized by various analytical techniques such as XRD, XPS, UV-DRS, SEM and EDX and applied for the degradation of Bisphenol A (BPA). Bisphenol A (BPA) is an endocrine disruptor. It is known that the BPA is one of the most harmful organic materials and that it does not degrade easily in the environment. It was therefore selected as a target to test the photocatalytic activity of prepared carbon nitride nanosheets under direct solar irradiation. The photocatalytic degradation of Bisphenol A by the g-C₃N₄ nanosheets under solar irradiation was much better (around 60%) than that with the g-C₃N₄ 3h bulk sample (around 30%). This enhancement on photocatalytic activity can be attributed to multiple factors such as the smaller particle size, rich carbon surface and high surface area exhibited by the g-C₃N₄ nanosheets. This further indicates that g-C₃N₄ can be used with solar irradiation to treat wastewater containing endocrine disruptor chemicals and other hazardous waste.



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Exposure to lead and risk of SARS-CoV-2 infection among ready made garments (RMG) workers in Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 6 : Hazardous waste remediation

Lead is a common environmental pollutant that poses a major hazard to public health worldwide. Elevated blood lead levels (BLLs) during reproductive age are of particular concern because lead freely crosses the placenta and can cause adverse effects on pregnancy and birth outcomes. More than 800 million children are estimated to have blood lead concentrations that exceed 5.0 µg/dL; however, there is a lack of data for the adult. Bangladesh phased out Pb in gasoline in 1999, yet elevated BLLs are still greater than a threshold value. Our primary aim was to assess the prevalence of elevated BLLs among women of reproductive age (WRA); investigate potential sources of Pb exposure and evaluate the association between Pb sources and high BLLs. We piloted this case-control study in two readymade garments (RMG) factories in Bangladesh from August 2020 to December 2021, with six months paused due to the COVID-19 pandemic. The selected garment factory has no known industrial exposure nearby and is located in Dhaka city, considered a control site and second (case) garment factory 200-500 meters from an active lead-acid battery recycling (ULAB) site was in outside of the Dhaka. We recruited 100 participants from each garment to evaluate the BLLs, health metrics such as BMI, hypertension and COVID-19 reported cases. We also evaluated ambient air lead level, house dust, spices and personal care products as a potential source of exposure. The odds and risk of elevated BLLs were higher for respondents in the exposed group (OR = 2.45, CI [1.39, 4.32] and RR = 1.56, CI [1.17, 2.09]). Also, the COVID-19 infection rate was reported 10% higher among the exposed group. The X-Ray Fluorescence analyzer detected lead in dust, turmeric and chili powder, and the median lead concentration was higher for the exposed site. Lead was also detected in – Lipstick, face whitener and Surma. The exposure status and age were significant among different risk factors at a 5% significance (p-value < 0.05). Tap connected by metal pipes as drinking water sources were also a significant risk factor at a 10% level of significance. At present we are analyzing air-lead level data from both sites.

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Assessment of high nitrate concentration in soil of Thar Desert, Pakistan and its removal from the groundwater

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 6 : Hazardous waste remediation

The Thar Desert, situated in the south-eastern part of Pakistan in the province of Sindh, is one of the most inhabited deserts of the world. Like other deserts of the world, the population living in the Thar Desert is completely reliant upon groundwater as their only source of water. WHO considers nitrate up to 50 mg/L in water as a safe level for human consumption. High nitrate concentrations in drinking water have been linked with different health related issues such as methemoglobinemia, birth defects, and cancers of different kinds. Infant children and ruminant animals are the most vulnerable to the adverse health effects of high nitrate concentrations.

Present study is carried out to assess the magnitude of high nitrate concentrations, its spatial distribution, and its probable sources, by investigating the nitrate concentration in soil and groundwater samples from multiple locations throughout the Thar Desert at surface as well as variety of depths. In this connection 200 surface soil samples and 12 depth profile samples in addition to groundwater samples from the same locations were collected from different sites of the desert. Textural analysis of the soil samples revealed that the soil of the Thar Desert is predominantly sandy or sandy loam soil (> 80% samples) with very low organic matter content (mean = 0.44%) which is a typical trait of the deserts around the world. Nitrate concentrations had high variation with a minimum recording of 15.95 mg/kg to a maximum of 77,500 mg/kg. Highest levels of nitrate (> 1,000 mg/kg) have been found in 44 samples which all came from a belt of high nitrate along the south-east to the western side of the Thar Desert. Dug-Well soil samples have also shown consistently higher nitrate irrespective of the depth and an average of 108.3 mg/kg nitrate has been observed for a depth up to 60 m from the surface. No appreciable correlation has been found between nitrate and other geochemical parameters.

In groundwater, mean nitrate has been found to be 210.4 mg/L which is fourfold greater than the WHO guideline value and 77% of samples were found to have nitrate concentrations surpassing the recommended limits. A spatial distribution map was generated using the data from this study which showed that high nitrate concentrations are quite prevalent over the entire Thar Desert area.

Isotopic analysis of the results has shown a great deal of variation in the $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ with general depletion observed for both $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$. Such variations indicate that nitrate contamination is originating from variety of sources. These sources may include fixed nitrogen from atmosphere and its subsequent nitrification, animal manure and dry deposition. There are certain regional malpractices which may also play their role in nitrate contamination of well water, including but not limited to; direct introduction of animal



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Plastic and human health

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Plenary 3 : Health effects of plastics exposure across the life span

More than 8 billion metric tonnes (Mt) of plastic were produced between 1950 and 2015, approximately 1 metric tonne for every person on the planet. Global plastic production has grown exponentially with production continuing to accelerate but with less than 10% being recycled. Mis-managed plastic waste was estimated to be 60-99 million Mt in 2015 and predicted to more than double by 2060. Environmental plastic pollution is thus highly visible and was recently recognized as a global threat with the landmark resolution at the UN Environment Assembly in March 2022 to negotiate an international legally binding agreement to end plastic pollution.

However, plastic is not only a waste issue, it is also a health issue. Plastic comprises a polymer matrix with chemical additives which allow the production highly diverse materials which are used in every aspect of our lives including construction, transport, household goods and toys, medical applications, textiles and packaging. Plastic breaks up into micro- and nanoplastic particles and have been found in human lung, colon and placenta biospecimens as well as stool with plastic polymers recently being detected recently in human blood. However, we know little about how far they have penetrated our organs nor their health effects in humans. By contrast, much more is known from epidemiological studies about the health impacts of monomers such as Bisphenol-A (BPA) and additives, such as plasticisers and flame retardants. These plastic chemicals are not strongly bonded to the polymer, leach out of products during every-day use and have been found in a wide range of human biospecimens including seminal and follicular fluid, amniotic fluid, mothers' urine during pregnancy, cord blood as well as in children and adults.

Dr Symeonides will describe human health impacts of some plastic chemicals across our lifespan and Professor Ponsonby will discuss the effects of higher maternal prenatal chemical levels on children's brain development. Dr Brunner will reveal some developments in the quest for safe and sustainable alternative materials. Lizzie Fuller will conclude with insights into how toxic chemicals are regulated and ways that the global plastics treaty could address the human health of plastics.



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Plastic chemicals and human health – what do we know?

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 3 : Health effects of plastics exposure across the life span

Plastics materials in consumer products are complex mixtures of industrial chemicals, including polymers, functional additives, impurities and other non-intentionally added chemicals; with human health hazards across the chain of production, use and waste. These human health hazards include both direct hazards and indirect hazards, such as through environmental degradation or occupational risks related to the production of various plastic chemicals, as recently summarized in our review “Buy-now-pay-later- link will open in a new window: Hazards to human and planetary health from plastics production, use and waste” (Symeonides et al. 2021).

This presentation will take a deeper dive into direct hazards of plastic chemicals, with a specific focus on some of the best studied plastic chemicals: phthalate plasticisers, halogenated flame retardants, bisphenols, and PFAS chemicals. It will separately touch upon some of the unknown and emerging hazards, including micro- and nanoplastics.

I will present early findings from two pivotal literature reviews by the Minderoo Foundation using systematic methodologies. Together with the Joanna Briggs Institute, we undertook an umbrella review of the existing systematic review literature – a systematic review of the systematic reviews in the field. The umbrella review shows that humans are exposed to plastic chemicals throughout our lifespan, that is from before conception, during pregnancy and at birth as well as postnatally and as children and adults. Health impacts are numerous and include reduced birthweight, miscarriage, neurodevelopment, type 2 diabetes, obesity and cardiovascular disease. In addition, we undertook a scoping review which has comprehensively mapped the breadth and volume of primary research on plastic chemicals and human health over the last 80 years. Alongside concerning evidence from the umbrella review of harm to human health for plastic chemicals that have attracted independent research, the scoping review brings out the gaps in our knowledge of the broader ecosystem of plastic chemicals. Together, the two reviews highlight a critical need to revisit the evaluation and surveillance of high-volume industrial chemicals for human health harms.

Pathways to safer plastic

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 3 : Health effects of plastics exposure across the life span

Every day we take advantage of the benefits of plastic in electronics, food packaging, construction, and medical applications. Often not realising that we are exposed to micro- and nanoplastics which break off during daily use of plastic bottles and packaging, tyre abrasion as well as decay of mismanaged plastic waste in the environment; microplastics are even intentionally added to personal care and cleaning products. Even less visible are the threats posed by additives and contaminations in plastic materials that can leach out of the polymer matrix and which are ingested, absorbed, or inhaled. Phthalates, bisphenols, and polyfluorinated alkyl substances are just a few examples of plastic chemicals that are associated with harm to human health. There are three crucial pathways to reducing the impacts of plastic on human health and the environment without losing the many advantages that fossil-fuel based plastic provides.

1. Biopolymers, with similar mechanical properties as conventional plastic polymers, are produced from natural resources such as plant-oils, sugars or cellulosic biomass to make “bioplastic”. Production at scale and efficient compounding can result in biodegradable or compostable plastic materials i.e. they break down into constituent molecules rather than break up into micro-/nanoplastics. Biopolymer use in packaging materials and products, especially single-use, that are likely to be lost into the environment will reduce the uncontrolled release of nondegradable micro- and nanoplastics and provide safer alternatives to conventional polymers. However, care must be taken not to use harmful plastic additives.

2. Advanced recycling technologies like depolymerization, whereby plastic is broken up into monomers, or solvolysis in which plastics are dissolved, purified and the polymer chains reprecipitated, produce recycled plastic with (close to) virgin quality. In combination with better sorting and separation techniques, advanced recycling will increase circularity of conventional polymers and biopolymers alike and ensure safer, contamination free recycles and less microplastics in the environment.

3. Substitution of harmful plastic additives with safer alternatives will be facilitated by modern testing and modelling approaches like in silico toxicity assessment of chemicals. Combined with regulatory frameworks such as essential-use and functional substitution concepts this will accelerate the marked adoption of safer plastic additives while avoiding regrettable substitutions.



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Plastics and chemical regulation

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Plenary 3 : Health effects of plastics exposure across the life span

Over the past 60 years, plastic has become ubiquitous in our society around the globe. As a result, the cycle of plastics and polymer production, supply, use, disposal and recycling increasingly crosses national and state borders and intersects with the mandates of multiple regulators, even within a single national system. The complex patchwork of regulatory landscapes relevant to the plastics supply chain include those dealing with import/export (of both products and chemical components), industrial chemical management, environmental management, food safety, therapeutic goods safety, consumer goods safety, occupational health and safety, and waste and recycling management.

From a human and environmental safety perspective, the efficacy of these regulatory systems depends on knowing what is hazardous, removing hazardous chemical components and polymers from virgin plastics, and safely managing recycling of plastic products and polymers already in existence. However, current regimes largely operate in the dark on many of these fronts. Firstly, there is little transparency around, or monitoring of, the chemical components in plastics; secondly, a large number of industrial chemicals used in plastics have not been comprehensively evaluated by regulators, despite being in products in the market; and thirdly, many chemicals used in plastics have not yet been studied for their impacts on human health. The UN Environment Assembly resolution to negotiate an international legally binding agreement to end plastic pollution presents an opportunity to address these issues at a global scale.

This talk will offer a high-level view of the existing plastics regulatory landscape and explore the potential for improving the regulation of the human and environmental health risks posed by plastics.

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A numbers of microplastics detected in pregnant women's stool

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Symposium 7 : Microplastics

Microplastic might be present in food and drink through various sources. Pregnant women will expose to microplastic through the consumption of contaminated food. Microplastic contamination in pregnant women might bring adverse health effects to the fetus. This study aims to observe the existence of microplastics in pregnant women's stools.

The research was conducted in South Sulawesi, Indonesia. Thirty health pregnant women in two community health centres named Pattingalloang dan Jumpondang Baru, Makassar City, participated in this study. Their stools were analyzed to explore the microplastic using Fourier Transform Infrared (FTIR) microspectroscopy.

All stools contained a total of 359 microplastics in the range of 4-21 particles with 0,2-4,9 mm per 25 gr stool. The polymers included Polyethylene Terephthalate (PET), Polyamide/Nylon, Polyethylene Chlorinated, HDPE dan Ethylene propylene.

A number of MPs detected in pregnant women's stool

KEYWORDS microparticles; plastics; faeces; pregnancy



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The occurrence and potential sources of microplastics in the tropical coastal and estuarine ecosystems of Port Dickson and Klang River, Malaysia

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 7 : Microplastics

Microplastics have been considered as contaminants of emerging concern due to ubiquity in the environment. The Klang River estuary and Port Dickson are important ecosystems that receive various contaminants from urbanised, highly populated areas and the busiest maritime centre in the Southeast Asia region. This study investigates the abundance and characteristics of microplastics in surface water of the Klang River estuary and Port Dickson coastal areas. The abundance of microplastics ranged from 0.5 to 4.5 particles/L with a mean abundance of 2.47 particles/L in the estuary of the Klang River. Meanwhile, mean microplastic abundance ranged from 2.10 to 6.80 particles/L in the coastal area of Port Dickson. The microplastics in the surface water were predominantly in the 300–1000 µm size class, followed by > 1000 µm and < 300 µm, and were mostly transparent fibres, fragments, and pellets. Polyamide, polyethylene, cellophane, and polyester were the main polymer types in the composition of the microplastics, suggesting that the microplastics originated from heavily urbanised and industrial locations such as the port, jetty, and residential areas. The widespread occurrence of microplastics in the environment and subsequent penetration of aquatic food webs may pose a serious threat to organisms. This study provides baseline data and a framework for further investigation of microplastic contamination in estuaries and coastal areas.

A temporal assessment of microplastics distribution on the beaches of three remote islands of the Yasawa Archipelago, Fiji.

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 7: Microplastics

The aim of this project is to investigate long-range atmospheric transport of microplastics in the South Pacific. Microplastics are known to undergo long-distance transport in rivers and oceans, however, this is the first investigation into long range atmospheric transport of wet and dry samples. The field work is being undertaken in Australia, Fiji, Tonga, New Zealand and The Solomon Islands. This is the first study that investigated the presence, distribution, and composition of microplastics ("MPs", particles 1 - 5 mm) on beaches in the Yasawa Islands, Fiji. The average concentration across all beaches was low (4.5 ± 11.1 MPs.m⁻²) compared to other studies globally. MPs abundance varied between sites, with average concentrations as low as 0.2 ± 0.6 MPs.m⁻² to a maximum of 13.7 ± 25.7 MPs.m⁻². Significantly higher concentrations were found on east-facing beaches than west ($p < 0.001$), and higher on the storm line compared to the high tide line ($p < 0.001$). No difference was found between tourist and local beaches ($p = 0.21$). ATR FT-IR analysis showed that across all sites 34% of MPs were polypropylene (PP), 33% polystyrene (PS), 25% polyethylene (PE), and 8% other polymer types. Further studies are needed to assess the potential impacts of MPs on Fiji's coral reefs and marine life.



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Nutritional modulation of environmental toxicity and implications in inflammatory diseases

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 9 : Nutrition

Many non-communicable diseases, such as atherosclerosis and other cardiovascular diseases, are defined as inflammatory diseases, which suggests that multifactorial interactions linked to exacerbated disease pathology include pro-inflammatory chemical and non-chemical stressor. Recent data suggest that genetic and lifestyle factors are independently associated with susceptibility to cardiovascular disease. Thus, potential biological interactions between chemical and non-chemical stressors and buffers and other lifestyle factors will determine disease outcome. Chemical stressors include environmental pollutants with pro-oxidant and pro-inflammatory properties, such as polychlorinated biphenyls (PCBs), which are also persistent organic pollutants that have an affinity for the aryl hydrocarbon receptor (AhR). AhR ligands lead to induction of cytochrome P450s and free radical formation, followed by inflammation. For example, dioxin-like PCBs can increase endothelial cell dysfunction, activation and inflammation (e.g., increased adhesion molecule expression and cytokine production). Our data suggest that nutrition, or the type of diet we eat, can modulate environmental insults and disease outcome. For example, fats/oils high in omega-6 fatty acids can act as pro-oxidative and pro-inflammatory stressors. In contrast, foods rich in omega-3 fatty acids and plant-derived polyphenols or bioactive compounds can act as non-chemical buffers. Many environmental pollutants and pro-atherosclerotic nutrients/diets can activate nuclear factor- κ B (NF- κ B) signaling leading to increased oxidative stress and inflammation. In contrast, many anti-inflammatory nutrients and/or bioactive phytochemicals can decrease inflammation by activating nuclear factor erythroid 2-related factor 2 (Nrf2) signaling. Our data, including metabolomic profiling, suggest that the pathology of dioxin-like PCB-mediated inflammatory diseases is complex and may involve disturbances in the gut microbiota, liver and vascular tissues. Of special interest are approaches of prevention/intervention to lower disease outcome linked to complex interactions of chemical stressors to modify cardiovascular disease outcome. Consuming healthy diets rich in plant-derived bioactive nutrients may reduce the vulnerability to diseases linked to environmental toxic insults. This nutritional paradigm in environmental toxicology requires further study in order to improve our understanding of the relationship between nutrition or other lifestyle modifications and toxicant-induced diseases. (Supported in part by NIEHS/NIH grant P42ES007380)

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Identification and management of moderately and severely wasted under-five children, and risk factors of wasting among under-five children in Bangladesh : A systematic review

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 9 : Nutrition

Wasting (weight-for-length or -height <-2 z-score among under-five years old children or mid-upper-arm-circumference <125 mm among 6-59 months age group) is a notable global nutritional- and public-health burden including Bangladesh. Wasting makes children too thin and weak, and puts the children at higher risk of illnesses; poor growth, development and learning; and dying. In 2020, globally, 45.4 million under-five children were wasted, 14.3 million were severely wasted (WHZ <-3 or MUAC <115 mm), and $> 50\%$ lived in Southern-Asia. Multiple integrated-interventions are often needed to address underlying causes as well as immediate symptoms including: a) nutrition counselling and education; b) supplementary feeding; c) therapeutic feeding and hospitalization (for severely wasted children with illness or lack of appetite); and d) complementary actions aimed at disease prevention, psychosocial care, shelter, etc. To effectively address the problem of wasting among under-five children in Bangladesh, knowing the prevalence, and its causes and associated factors are essential steps. A rapid review has just been conducted to identify the existing literature and available other documents that mentioned the individual, socioeconomic, demographic and contextual risk factors associated with wasting among under-five children in Bangladesh.

Methods: The electronic databases searched include PubMed (MEDLINE), EMBASE (OVID platform), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science (WoS) and Cochrane Library. Papers/articles written in the English language, and for which the publication date was before 31 July 2021 were considered. The search from the five databases yielded 160 publications. Of these, 50 papers/articles were found duplicates and 102 were identified as irrelevant and the rest 8 have met inclusion criteria. Additionally, 22 articles/documents identified from other sources (e.g. searching the cross references and from Google search engine). Finally, a total 30 articles/documents have been included in this review. The prevalence of wasting among under-five children in Bangladesh is still high, and the risk/associated factors were found at various multilevel. Rarely caused by any one factor alone, wasting results from an interplay among poverty, disease, caring practices and diets, which vary by contexts. Therefore, top priority should be given to reducing the rate of wasting as a major public health intervention.

KEYWORDS Risk factors; Moderate wasting; Severe wasting, Under-five children; Supplementary food, Therapeutic food.



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Influences analysis of determinant factors to helminthiasis and nutritional status in school children thorough structural equation modelling

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Symposium 9 : Nutrition

Soil transmitted helminths (STHs) are known as an neglected diseases with the incidences still reporting in developing countries. STHs has affected to nutritional status for growing and leading problems in children school age.

This research aimed to explore the influence of socio-economi, sanitation, behavioral, and environmental factors simultaneously to helminthiasis and nutritional status of the children.

This was a cross sectional study conducted in 2018 in five different subdistrict in Makassar city. All participants were school age children between from 8 to 15 years old. Parents were included to collect data on child-family information and socio-economy. The environmental factors data were observed in respondent house. Helminthiasis were analyzed using Kato Katz method in Parasitology medical faculty of Hasanuddin University. Multivariate variable analyzed through Partial Least Square (PLS) modelling with using SMART PLS Software. A total of 350 children were included, of whom 46 (13.2%) were thinned, 68 (19.4%) were overweighted, 39 (11.1%) were anemia and 48 (13.7%) were infected by helminthiasis. The result of assessment of modelling were Personal hugyene has effect on helminthiasis (β 0.130, t 2.869) and helminthiasis program has effect on helminthiasis (β 0.2454 , t 2.005). Other variables gived no significant effect oh helminthiasis. Both of helminthiasis and nUtrient Intake have no significant effect to nutritional status.

In conclusion, the research reported that peronal higyene and helminthiasis program were the variables that influence helminthiasis on school children. Effective strategies are needed for controlimg children hygiene at school. Importantly, education of healthy nutrition should be part of school curriculum.

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Effects of soil properties and plant biomass on the health of przewalski's horses in Hustai National Park, Mongolia

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 4 : The latest issues in climate change and their solutions

Przewalski's horses (*Equus ferus przewalskii* or Takhi), once part of the Mongolian steppe fauna, disappeared by the late 1960s. It is believed to have become extinct due to climate change, pasture competition and hunting. In 1994, 14 horses were reintroduced to the Hustai Mountains in Mongolia. Since then, the total number of horses has increased to 414 (n=414) by the end of 2021 which accounting for about 20 percent of the world's population. Hustai National Park (HNP) is a located by the joint of ecosystems of the forest-steppe and dry-grassland in the southern boundary of Mongolian forest population. In recent years, the number of livestock (sheep, goat, cattle and horse) and wild animals (red deer-cervus elaphus), wild boar-sus scrofa), argali sheep-Ovis ammon, Mongolian gazelles-gazella guterosa) around the HNP has been increased. The diet, grazing and living habitat of these animals are similar to Przewalski's horse. Thus, overgrazing may have an effect on the biological status of soils and on the biodiversity of protected areas. Several studies have reported an existence of limiting factors, effecting the population growth of Takhi, such as sufficiency of food and drinking water, and other environmental conditions. In addition to climate change and its consequences, the chemical properties of the soil can also negatively affect the health of animals due to the increased content and concentration of toxic substances in soil. Plant photosynthesis, energy transfer, and the movement of nutrients inside are all related to soil phosphorus (P) which is an essential element for animal growth. In this study more detailed soil nutrient element of P and compared it with other natural birch forest (outside of the HNP) soils. In order to test either soil chemical composition and their content in the soils effect to Takhi health, we designed to carry out plant and soil assessments in 6 different communities treatments, including forest interior, forest edge, forest meadow and steppe, respectively. In each treatment, the soil sampling and plant extracting conducted for elemental and geochemical analyses at the laboratory. The results of the investigation clearly indicated the existing forest degradation in HNP area, which were proven by decreased growth rate, accumulation of dried trees, poor natural regeneration, soil moisture loss and bulk density increase. Analyses of phosphorus suggested that less organic phosphorus and rich in Ca-P minerals of HNP soil.



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Medical wastes generation coefficients in Vietnam

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Plenary 4 : The latest issues in climate change and their solutions

This study was conducted to estimate medical wastes generation rates in Vietnam. Within 3 years (from 2017 to 2019), total medical wastes generated within a day from 1,737 health-care facilities at different levels from 19/63 provinces in Vietnam were surveyed and recorded. The calculation was based on median daily generation of 6 medical waste groups (kg) and total actual patient beds in 9 health-care facility categories. Six medical waste groups were sharps, non-sharps, high-risk infectious, pathological, non-infectious hazardous, recyclable and non-recyclable wastes. Surveyed health-care facilities were categorized in central general hospitals, central specialist hospitals, provincial general hospitals, provincial specialist hospitals, district health centers, regional clinics, commune health stations, private hospitals and private clinics. The results showed that there were large ranges in waste generation rates between medical wastes and health-care facilities, which varied from 0.0009 to 1.619 kg/bed/day, except for commune health stations and private clinics, due to there were no actual patient beds, medical waste generation rate for these two were calculated in kg/day and varied from 0.1-1.75 kg/day.

KEYWORDS Medical waste generation rates, health-care facilities in Vietnam

A market-based study of total, inorganic and bioaccessible arsenic in Thai rice

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)

Plenary 4 : The latest issues in climate change and their solutions

Arsenic (As) in rice grain is an important public health concern since As is a human carcinogen. Rice is a staple food and a main exported agricultural product of Thailand. This study was conducted to determine the actual concentrations and estimate the probable ranges of As in rice. Different statuses of As accumulation in rice grain were also determined. White (n=154) and brown (n=54) rice samples were collected for 3 crop years from various local markets. Concentrations of As (total, inorganic and bioaccessible) were determined. The total As concentrations in white (0.088–0.295 mg/kg) and brown (0.119–0.517 mg/kg) rice were approximately 58.8% and 57.4% greater than the Codex standards, respectively. However, inorganic As and bioaccessible in both types of rice were lower than the standards of 0.2 mg/kg in white rice and 0.35 mg/kg in brown rice. The actual concentrations of As were then used to estimate the probable ranges of As that can be found in rice. Regarding the four classifications of As accumulation (low, normal range, high and unusually high) in rice, the actual As concentrations found in the collected rice samples fell into either the normal range or high level of As.



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GDM filtration technology for the treatment of domestic sewages in densely populated communities in Metro Manila

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 4 : The latest issues in climate change and their solutions

Several surface waters in Metro Manila, Philippines have already been deteriorated due to excessive inputs from domestic wastes, and needs treatment for physical (pH, solids), chemical (such as alkalinity and excessive nutrients) and microbiological contamination. In line with the 2022 IERI Research Proposal theme on “Implementation of water treatment technology in the field”, this study is incorporating the GDM filtration technology in the community-level water treatment technology in a control site in UP Diliman (UPD) and in the site of interest Maningning Creek (MC). Analysis of the water quality for physico-chemical parameters were performed for both UPD and MC to determine the extent of contamination. From the one year accumulated monthly water quality monitoring, the pH and total dissolved solids are compliant to the Water Quality Guideline for Class C waters as per the Department of Environment and Natural Resources Administrative Order 2016-08 and 2021-10. The values for NH₃-N (ammonia-nitrogen) levels in UPD ranges from 0.04 µg/m³ to 10 µg/m³, while for MC the range is from 0.5µg/m³ to 25 µg/m³; the guideline value is 0.5µg/m³. On the other hand, the Phosphate level ranges from 0.60 to 7.10µg/m³ in UPD, while from 0.4 to 17.5 in MC; the Phosphate guideline value is 0.5µg/m³. Nitrate-Nitrogen (NO₃-N) and Total Alkalinity are also being tested. The bench-type utility model of the community-level water treatment technology is being developed. Improvements (if any) in the quality of the surface water before it reaches the larger basin of Laguna de Bay will be reported in the Pacific Basin Consortium International Conference.

KEYWORDS Gravity-driven membrane, surface water treatment, water quality, Metro Manila, community-level wastewater treatment device

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Study on the characteristics of health monitoring of humidifier disinfectant victims

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 5 : IERI and WHO CC for vulnerable population and environmental health

The humidifier disinfectants incident began in 2006 as a number of patients with unknown causes of lung disease occurred. In 2011, lung damage caused by the humidifier disinfectants was confirmed. Until now, many people have died and are suffering from humidifier disinfectants. In particular, many victims were children and child-bearing women who are more vulnerable to chemical exposure. Since 2018, the National Institute of Environmental Research (NIER) has designated university hospitals (13) as the Humidifier Disinfectant Health Center to provide health monitoring to victims. Health monitoring is a medical service provided once a year and is conducted to examine mid-and-long term changes in health of those exposed to humidifier disinfectants and accumulate their related medical records after the exposure to humidifier disinfectants. From 2018 to 2020, the total number of health monitoring subjects increased by about 22% from 3,688 to 4,514. In the case of the children group, the number of subjects increased from 1,240 to 1510, and the participation rate increased by more than 10% from 33% to 44%. In the children group, among the diseases recognized as damage caused by exposure to humidifier disinfectants, asthma and pneumonia were the most common diseases, followed by humidifier disinfectant lung injury. In this study, the health monitoring data for the past three years were examined to analyze the relationship between humidifier disinfectants and health effects. The health monitoring results of follow-up for three years will be discussed in detail later.



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Current research progress and future plans of KoCHENS

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 5 : IERI and WHO CC for vulnerable population and environmental health

The Korean Children's ENvironmental health Study (Ko-CHENS) has been established since mid of 2015 and recruited a total of 70,000 mothers through its two enrollment tracks (65,000 in the Main Cohort and 5,000 in the Core Cohort) from Jan, 2015 to Feb, 2021. Concurrently, in order to investigate children's rare diseases on a national scale, we have launched the Big Children's ENvironmental health Study (Big-CHENS), which is the population-based birth cohort with 1.7 million mothers. The main contents and specific aims of Ko-CHENS and Big-CHENS include: (i) population based cohort study with the purpose to investigate the association between environmental toxicants and children's health; (ii) the establishment of the Big-data driven cohorts which enable researchers to study rare diseases or deaths in children; (iii) further, infrastructure to conduct a family study. As of March 2022, Ko-CHENS and Big CHENS have obtained 53,185 and 1,766,577 mother-child pairs respectively and have constructed databases on insurance claim information (qualification, diagnosis, medical utilization, health check-up and death) and address-based environmental exposures (e.g. outdoor air pollution, greenness, and climate). During the 2015-2020 study period, the rate of preterm birth was 7.1% and the rate of low birth weight was 6.1%.

Climate change and health in the Western Pacific Region

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 5 : IERI and WHO CC for vulnerable population and environmental health

Climate change is the predominant environmental risk magnifier for health issues in the Pacific. The WHO-Regional Committee Document "For the Future – Towards the Healthiest and Safest Region", highlights Climate Change, the Environment and Health (CCE) as a thematic priority for WHO work in the Western Pacific Region for the coming five years. The CCE thematic priority across four pillars are: (1) Advocacy - raising the profile of the CCE agenda by building new narratives and articulating health co-benefits of actions and policies from non-health sectors; (2) Building resilience into health systems to withstand the impacts of climate change and environmental threats; (3) Monitoring the impact of CCE on health; (4) Applying a CCE lens to all WHO work. Climate change-related health impacts and risks are becoming increasingly complex and more difficult to manage. Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risks. The capacity of health systems to prepare for and effectively manage the impacts that arise will vary. For each health outcome, there are a mix of interventions that can be identified along the pathways of exposure, vulnerability, impact, and capacity. Using a back-casting perspective, the pathways for increasing resilience can be identified. The health impacts of climate and environmental change will be determined mainly by the vulnerability of populations and their resilience to the current rate of climate change and the extent of adaptation. Small Island Developing States are uniquely vulnerable with the highest relative losses from climate disasters. At the same time, they carry heavy burdens of noncommunicable diseases and malnutrition. Pathways for increasing resilience to sea level rise in Pacific countries include reducing exposure to storm surge and king tides through coastal protection, moving infrastructure, including hospitals. The detrimental impacts of climate change on mental health and the impacts of exposure to high temperatures for adverse pregnancy outcomes such as stillbirths need to be considered. To address climate change and other environmental impacts on health will require engaging with multiple ministries, agencies and organizations in sectors including transport, energy, food production, water resources and urban planning.



Andrea Hinwood

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Environmental exposures in the Asia-Pacific region in a changing climate

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Plenary 6 : Programs to ensure children's wellbeing

The global community faces significant stressors in the coming years from the interrelated triple planetary crises of climate change, biodiversity and nature loss, pollution and waste. The current expected temperature rise of 2.4oC in the absence of further and deep mitigation to keep temperature increase to 1.5oC will have significant implications for other environmental exposures, notably air pollution but also the increased transport of pollutants in the environment, increasing risk of eutrophication and increases in microbial contamination in specific settings. Pollution has been associated with 9 million deaths annual globally (Lancet Commission on Pollution 2022) while air pollution alone is responsible for an estimated 7 million deaths.

Short lived climate pollutants such as methane impact both the climate and also the formation of tropospheric ozone which has significant implications for human health and agriculture. Emissions of air pollutants such as PM2.5 are also associated with emissions of greenhouse gas emissions. Action to address air pollution will improve health burden but also help in mitigating climate change.

The Asia Pacific Region has an estimated 4 million people dying prematurely because of air pollution exposure. South Asia and East Asia in particular have one the highest costs from mortality and morbidity associated with PM2.5 emissions. Women, children, elderly, and people living in poverty are at greater risk from impacts of air pollution. Without control of PM2.5 emissions, a warming planet will exacerbate the impact on health and costs to the health system and continue the emission of greenhouse gases creating more warming. These issues will be outlined along with solutions and actions to address the environmental dimension of the Sustainable Development Goals.

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Redistribution of potentially toxic elements in the hydrosphere after the relocation of a group of tanneries in Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Simultaneous relocation of a group of pollutant sources in a heavily polluted area is a rare event. Such a relocation has been implemented in Hazaribagh, a tannery built-up area with heavy pollution, in Bangladesh. This provides a valuable opportunity to compare the changes in environmental conditions associated with the relocation of multiple putative sources. Our environmental monitoring for a period of 6 years at the stationary areas centered on Hazaribagh geographically revealed trivalent [Cr(III)], hexavalent [Cr(VI)] chromium, lead, iron, and manganese as tannery-related elements after the legal deadline for tannery relocation. The median Cr(III) level in canal water, into which wastewater from tanneries was directly discharged, after the relocation was 97% lower of that before the relocation, indicating a beneficial effect of the relocation. In contrast, the median Cr(VI) level in water samples just after the relocation and 2 years after the relocation were approximately 5-fold and 30-fold higher, respectively, than those before the relocation. These results indicate not only a harmful effect of the relocation but also the possibility of conversion from Cr(III) to Cr(VI) in nature. Although the health hazard indexes considering all of the tannery-related elements in all of the canal water samples before the relocation exceeded the safety thresholds, the percentages of samples in which the indexes exceeded their safety thresholds after the relocation decreased by 32.5% – 45.0%. Treatment with our patented hydrotalcite-like compound consisting of magnesium and iron (MF-HT) resulted in decreases in the health hazard indexes in all of the water samples in which the indexes exceeded their safety thresholds to levels lower than their thresholds. Thus, this study shows the double-edged effects associated with the relocation and a potential solution.



Besral dan Evi Martha • Ulfi Hida Zainita

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Indonesian adolescents' well-being and knowledge of climate change

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Climate change is threatening humanity and it has caused health problems globally. Climate change affects the social and environmental determinants of health, and already leads to death and illness from frequent extreme weather events, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. The climate crisis threatens to undo the last fifty years of progress in development, global health, and poverty reduction, and to further widen existing health inequalities between and within populations.

Climate change is disrupting the well-being of populations of all ages. The total population of adolescents 10-19-year-old in Indonesia in 2019 was 45,351,034 people, which means 6% of Indonesia's population. This population is among the most vulnerable to the effects of climate change. Climate change poses risks and threatens the fundamental rights of adolescents. The adolescents' knowledge is important in tackling climate change and is a key to protecting the well-being of all generations, and promoting their right to choose and resilience. This systematic review aims to emphasize that knowledge concerning climate change is fundamental to maintaining the well-being of adolescents.

Indonesia as a middle-income country with rapid industrialization and high population density is experiencing the risks of climate change. Drought, flooding, landslides, sea-level rise, and forest fires are among the impact of climate change. Indonesia also faces infection and vector-borne diseases such as malaria and dengue fever, decreased labor productivity, undernutrition, and air pollution. In Indonesia, 7% of respondents think that climate change is a serious problem even though 69.01% of respondents have a good understanding of climate change issues. However, 51.41% still have less supportive attitude. This showed that knowledge, perceptions, and attitudes about climate change have significant influence on the pro-environmental behavioral intentions of the younger generation.

This study concludes that knowledge concerning climate change is fundamental to maintaining the well-being of adolescents.

KEYWORDS climate change, adolescents, knowledge of climate change, pro-environmental behavior

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Chemical upcycling of polylactide (PLA) to produce electrospun nanofibers with super-hydrophobicity for oil/water separation and oil absorption applications

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Poly(lactide) (PLA) is a promising alternative to conventional materials due to its biodegradable and recyclable. Recently, the processes for converting its post-consumer wastes to other value-added products are of interest. In this present work, super-hydrophobic PLA-based nanofibers is developed by using the chemical recycling products of PLA. An alcoholysis with glycerol was employed to generate glycerolized PLA (gPLA), i.e., hydroxyl-capped lactate oligomers with tunable structures. The glycerolized PLA were then used as OH-templates for specifically reacting with a hydrophobic agent, alkyl ketene dimer (AKD). The PLA/gPLA blend nanofibers were fabricated by electrospinning. The surface of materials was modified by dipping them into an AKD solution to enhance their surface hydrophobicity. The resulting super-hydrophobic and oleophilic nanofibers exhibited a high oil absorption rate and capacity (lubricant, diesel, and cooking oil), with the reusability of more than 10 cycles. The materials were used as a filter, which showed high oil/water separation efficiency (100%) for practical use in the oil decontamination process. After application, the materials are designed to be reutilized by a similar chemical recycling process to achieve the circularity of materials.



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Mitigation of arsenic accumulation in crop plants using biofertilizer

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Elevated levels of arsenic in crop plants have been found in various regions worldwide, especially where agricultural soils have been affected by arsenic-enriched aquifer and human activities including mining, smelting, pesticide application and so forth. Given the highly toxic nature of arsenic, it is highly recommended that remediation should be carried out immediately to reduce this potentially toxic element transport from soil to crop plants. There are numerous methods to remediate arsenic contamination in soil, however, approaches for remediation of arsenic contaminated paddy soil to reduce arsenic accumulation crop plants have not been widely investigated. This study focused on the utilization of biofertilizer which is a combination of arsenic-accumulating microorganisms and adsorbent (or carrier) in order to achieve high efficiency of arsenic immobilization and ability to apply in the field. Thirty-two bacterial strains were isolated from 9 soil samples collected from Dongjin and Duckum mining areas in Korea using nutrient medium amended with 2mM sodium arsenite. Among isolates, the strain DE12, which was identified as *Bacillus megaterium*, exhibited greatest arsenic accumulation capacity (0.236 mg/g dry biomass) and ability to resist up to 18mM arsenite and 14 mM arsenate. Among 3 agricultural waste adsorbents studied, rice straw was proved to have higher adsorption capacity (0.104 mg/g) than rice husk and corn husk. Therefore, rice straw was chosen to be the carrier to form biofertilizer together with the strain DE12. Inoculation of biofertilizer in soil showed reduction of arsenic content in edible part of lettuce, morning glory and sweet basil by 17.5%, 55.4% and 34.1%, respectively compared to control group. Apart from arsenic, heavy metal analysis in these parts of lettuce also revealed the reduction of Pb content when applying biofertilizer. The use of biofertilizer may open up the potential application in the field for other food plants.

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Exposure levels and toxicity implication of metal bound size-resolved PM in the Northern Indian region

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Air pollution exposure specifically to Particulate Matter (PM) is global relevant study area owing to linkage with an array of health outcomes. Nevertheless, of PM concerned epidemiological studies, a major gap yet underlines the question of key component of PM directly influencing the risk. The present study is dedicated to toxicity evaluation of metal bound PM in indoor settings by exploring the bioavailability (using simulated lung environment) and health risk. PM measurements in different size fractions ranges (10-0.1 μ m) were collected using cascade impactor and filters were digested to explore the total (acid digestion) and soluble (ammonium acetate digestion) metal concentration. Results depict relative surge towards smaller diameter particle size of soluble fraction of toxic elements (Ba, Ni, Cr). Toxic metals (Ni, Cr) exhibited higher bioavailable fractions (>50%) specifically in summers despite of low PM concentration as compared to winters. This concludes that during annual course, times with low PM mass concentration (summers in our study) may not essentially be safer periods in regard to human health. Toxicity evaluation (through HQ and ELCR estimated through USEPA model) suggested receptors (adults > children) to be highly susceptible to health hazard in view of their indoor exposure to particle bound metals over the annual course of year. Highest value of non-carcinogenic risk was posed by metals (Mn, Ni) in PM_{0.25} while highest carcinogenic risk was posed maximally by metals (Cr(VI)) in PM_{2.5-10}. Overall, 811 adults and 243 children out of 1 million are likely to develop carcinogenic effects if exposed to such concentration levels. Besides, the cancer risk of bio-available form computed in the present study inferred that instead of assessing the total contents of trace metals, their bioavailable forms should be implied to assess the health risk in a better way.



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Development of outing indicators through correlation analysis between the COVID-19 confirmed cases and particle matter(PM) : Based on the measurement results of outing situation in Seongnam-City, Republic of Korea

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

This research aims to design a unified metric that helps locals determine the safety of outdoor activities given the time and their location. Due to the increasing concentration of particulate matter (PM) in urban environments coupled with the rapid development of the COVID-19 pandemic, there are several layers of complexity in deciding whether it is safe to go outdoors or not. In the case of South Korea's Seongnam-City, our survey shows that residents often voice concerns about the difficulty and ambiguity in interpreting numerous data sources for making their daily decisions. We noticed three problems within the existing framework: First, no platform tracks the air quality and COVID-19 metric simultaneously, causing the locals to go through multiple platforms. Second, all the COVID-19 platforms tracked the relevant metrics at the city level, ignoring the nuances in the district-level trend within each individual city. While government websites do provide district-level data points, they are hidden behind multiple levels of unintuitive UIs that lack a proper API call. Third, none of the platforms take into account the considering how epidemiological trends are dependent on their neighbors. As a result, such considerations are left to the users' own discretion.

We propose "Outing Safety Index,,", a platform that provides a unified metric that aggregates several data sources in order to focus solely on the safety of outdoor activities. Double-blinded preference tests on local citizens demonstrate certain outcomes. We build an active site for data collection using JAVA, MYSQL and JSP. Firstly we design the development environment and create program scenarios. The next stage is to build a website server, to develop a weather API and to develop a COVID-19 status API. Database environment is tested and the website is open to the public. We conduct the survey by providing this platform online to dwellers in Seoungnam-city, Korea in the early stage of 2022. Then we collect user database periodically and analyze the trend weekly basis since the weather in Korea during spring season is not so predictable. We maintain the server for 3 months at least and we monitor and trace the survey data during the period.

Firstly, we expect the result of correlation between the occurrence of COVID-19 case and air quality, particularly PM statistics. We obtain the result of COVID-19 and air quality metric based platform through the analysis of user database and trend. Secondly we find the proof for the assumption that daily occurrence of COVID-19 confirmed case is related on the air quality which could be verified with PM index. This is possibly to enable for citizens to alter their daily action plan and choose what to wear or where to cover at least.

It is common COVID-19 pandemic is inevitable at our workplace and even work from home trend. It is also

known that the air pollution evaded into daily life and affect our health. One of a few things we are able to cope up with the situation is to get informed in time and know what is supposed to do proactively at every moment of our living.

By developing the outing indicator, we expect the daily lives of the information users become more predictable and even safer than as it used to be. Or at least, users are able to get more space to consider and decide daily activities every morning.



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Persistent organochlorine pesticide exposure and breast cancer among Indian women : a possible linkage

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

In India, breast cancer is the most common cancer among women and has overtaken cervix cancer, which was the frequent cancer a decade ago. The etiology is remains unknown but environmental, genetic, nutritional and hormonal factors are established as contributory risk factors. The majority of breast cancer have been proposed to be of environmental origin. Among the environmental factors organochlorine pesticide have been suggested to play a causative role in the etiology of breast cancer. Organochlorine pesticides are widely dispersed and persist in the environment, act as xenoestrogen, get stored in adipose tissues and act as tumor promoter. Concentrations of organochlorine pesticides were measured in three biological media, blood, breast adipose tissue, and breast tumor tissue, of 205 breast disease cases. Gas-liquid chromatography determined blood, breast adipose, and tumor tissue levels of metabolites of dichlorodiphenyltrichloroethane (DDT) and isomers of hexachlorocyclohexane (HCH). The isomers of hexachlorocyclohexane such as alpha, beta gamma and delta and metabolites of DDT such as p,p-DDT, o,p-DDT, p,p-DDE, and p,p-DDD were frequently detected. Total organochlorine pesticide level in the blood samples were found higher in malignant group (n=116) i.e., 95.93 ppb, which is about 1.8 times higher than the mean of benign group (n=89) 52.43 ppb and about 2.7 times higher than control group (n=50) 34.36 ppb. In tumor tissue concentration were found about 1.4 times higher in malignant group (4601.05 ppb) when compared it with benign group (3206.11 ppb). And the burden of total organochlorine pesticides levels in adipose tissue of women with malignant (9176.15 ppb) and benign disease (7119.01 ppb), which is about 1.2 times higher in malignant group. However, if organochlorine pesticides are found to be the source and to play any causal role in development of breast cancer, then it might become possible to prevent breast cancer.

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Ambient particulate air pollution and premature mortality in two Asian megacities

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

A series of studies reported that short-term exposure to ambient particulate air pollutants has been associated with increased daily mortality, and the shape of the concentration-response relationship has been reported differently by location. This study compared the mortality risks of PM_{2.5} in two East Asian megacities, Seoul, South Korea, and Tokyo, Japan by conducting a time-series analysis. We adopted a quasi-Poisson log-linear model to formulate the concentration-response functions and estimated the associations between PM_{2.5} and mortality in each city. The daily mean concentration of PM_{2.5} in Seoul was about twice that of Tokyo, and we found a significant increase in mortality rate with increasing PM_{2.5} concentration in both cities. However, the disparity in the shape of the concentration-response curve was observed, indicating the importance of developing area-specific strategies and awareness plans for risk prevention that can serve as a basis for policymaking to reduce the corresponding health effects.



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Sociodemographic factors and spatial analysis that contribute to the development of tuberculosis in coastal setting

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Coastal areas in Indonesia are very vulnerable to infectious diseases such as tuberculosis. The aim of this study was to analyze sociodemographic factors and put it in spatial analysis.

We performed an analytic observational study with a case control study design. Interviews and measurements of home conditions were carried out on 156 people (52 cases and 104 controls) using purposive sampling technique with a ratio of 1:2 by age and sex matching. Data analysis used chi-square test and multiple logistic regression. Data was collected through Geographical Positioning System and then analyzed using buffering analysis and visualizing by Geographical Information System.

The results showed that the spatial analysis at greater risk was in Pasar Wajo District, the significant variables were trust (p-value = 0.003, OR = 2.878, 95% CI = 1.410-5.872), contact history (p-value = 0.001, OR = 6.750, 95% CI = 3,178-14,336), bathing habits (p-value=0,001, OR=4,659, 95% CI=2,287-9,492), lighting (p-value=0,012, OR=2,362, 95% CI=1,196-4,664), ventilation (p-value=0,022, OR=2.190, 95% CI=1.112-4.311), residential density (p-value=0.001, OR=8.298, 95% CI=3.648-18.876) while humidity, water availability and latrine ownership were insignificant variables. The results of the logistic regression test showed that occupancy density, bathing habits and contact history were the variables that had the most influence on the incidence of leprosy. The results showed that more than 50% of samples have a short distance (< 1 kilometer) to health services and they have good access to health services. Moreover, health access of TB patients can be used to support TB control programs, including decreasing incidence of TB.

KEYWORDS Sociodemographic, Spatial Analysis, Tuberculosis

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Identifying determinants of multidrug-resistant tuberculosis in Bangladesh : A case-control study

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Background : Tuberculosis is a public health problem in developing countries, and it is spreading through the air which is one of the environmental risk factors. Despite success in tuberculosis control, multi-drug-resistant tuberculosis in Bangladesh is increasing and currently, the multi-drug-resistant tuberculosis rate is 3.6% in new cases and 19% in re-treatment cases. This study focused on examining the determinants of becoming multi-drug-resistant tuberculosis, which helps to design an effective prevention strategy in Bangladesh.

Methods : A case-control study was conducted at selected three tertiary level Hospitals: Sylhet MAG Osmani Medical College & Hospital (Government), Jalalabad Ragib Rabeya Medical College & Hospital (Private), and Chest Disease Hospital (Government) in Sylhet, Bangladesh between November and December 2018. A total of 152 patients while 76 culture-proven multi-drug-resistant- tuberculosis cases and 76 tuberculosis patients were selected using purposive sampling techniques. Data were collected through face-to-face interviews with a structural questionnaire, and analysis was done using a descriptive and inferential technique with appropriate test statistics.

Result : Among the study, 69.1% of respondents were male where case 49 (32.2%), control 6(36.84%), and about 30.9% of respondents were female where case 27(17.8%), control 20 (13.2%). Around 40% of respondents never smoked where the case was 33, control was 28, which was the largest proportion for the respondents. Another 33% of respondents were current smokers, where the case was 24 and the control was 26, which was the middle proportion for the respondents. In addition, 27% of respondents were past smokers where the case was 11, control was 6, which was the smallest proportion for the respondents. Out of 152 respondents, contact with TB patient were 56.5% where the case was 33.6 % (51), control was 23% (35) and respondent who was no contact with TB patient 43.5%, where the case was 16.4% (25), control was 27.0% (41). Multiple logistic regression analysis revealed that participants who were female are 3.3 time more likely to develop MDR-TB than male [OR=3.333, 95% CI=1.120, 9.913]. The rural people were 72% more chance to develop MDR-TB than urban people [OR=1-0.279, i.e., 0.721, 95% CI=0.106, 0.733]. Respondents who had completed secondary educational status were 18.5 time less chance to develop MDR-TB than illiterate [OR=1/0.054, i.e., 18.518, 95% CI=0.007, 0.402]. Those who had contact of TB patient were found 67.7% more chance to develop MDR-TB than who had not [OR=1-0.323, i.e., 0.677, 95% CI=0.122, 0.851]. Participants those who had past history of TB treatment 92% more likely than those who had not [OR=1-0.077, i.e., .923, 95% CI=0.028, 0.221].

Conclusion: The overall finding revealed that a high level of drug resistance observed among patients who



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have a history of TB treatment and have had contact with TB patients led to the development of MDR-TB in the study area. Therefore, proper counseling of patients towards the first treatment and transmission of TB is needed in designing an appropriate intervention.

KEYWORDS Multidrug-resistant tuberculosis; Sylhet; Case-control; Drug resistance.

Risk assessments of mercury on the past MSW (municipal solid waste) landfill forest soil in 2022

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Landfilling is one of the simple methods to treat wastes technically and cost-effectiveness. However, it was employed indiscriminately in the past when environmental awareness was limited socially. Nagasaki Prefecture, Japan, had a representative landfill established in this past background, 1975, and it was initially targeted to treat the sewage sludge. Meanwhile, a large flood in Nagasaki Prefecture in 1982 generated substantial municipal solid wastes (MSW) such as damaged fluorescent lights, consumer electronics, household products, etc. The landfill in the prefecture managed this huge MSW, but considerable mercury (Hg) levels (0.81-8.48 mg/kg) were reported in the vicinity forest soil of the landfill in 1998. Although landfilling in this area was utterly discontinued in 2001, the mercury levels indicated that continuous monitoring and environmental risk assessment are essential. Therefore, this study determined the current Hg levels and their risk assessments.

Sampling was carried out on 25th April 2022. The surface forest soils were collected at the nine sampling points (LF1-LF9). Each sample was dried in a fume hood at room temperature over seven nights and was sieved using a 2.0 mm aperture size sieve. After then, approximately 30 mg of each sample < 2.0 mm was weighed in triplicates to measure the mercury. Total mercury (THg) in the soil sample was analyzed using the Hg analyzer, MA-3000 (Nippon Instruments Corporation, Tokyo, Japan). The recovery rate was verified using the certified reference material (ERM-CC850, European Commission) and was 110% (Certified value of the CRM 132±3 mg/kg).

The THg concentrations in soil samples range from 0.066 to 4.8 mg/kg-d.w., average 1.3±1.4 mg/kg-d.w., and median 0.77 mg/kg-d.w. (n=9). The median THg concentration is lower than the previous 2016 results (average 1.3±1.1 mg/kg-d.w., median 1.0 mg/kg-d.w., n=12). The entire THg levels in the sampling area are below the Korean soil guideline, 10 mg/kg in the forest lands. However, a geo-accumulation index (Igeo index) in LF3, LF6, LF8, and LF9 shows over than the Igeo class 3, indicating the strongly polluted. Though landfilling was stopped, continuous monitoring and reduction countermeasures are necessary.



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Prevalence of asymptomatic urinary abnormalities among the school - going adolescents in the rural area of Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Purpose : Generally, urinary abnormalities screening is considered an important measure for adults; however, there is no apparent concern for adolescent girls in developing countries. We aimed to determine asymptomatic urinary abnormalities through the routine microscopic urine examination among the school-going adolescent girls.

Method : A cross-sectional epidemiological study was conducted in the two schools between January to March 2022 at Chandpur, Bangladesh. We recruited 414 participants between 10-19 years with the grade 6 to 10 school-going adolescent girls. After ethical clearance from the institutional review board/ethics review committee of North South University Bangladesh, the authors collected first morning clean mid-stream urine specimens from the participants. Urinary red blood cell (RBC) and pus cell were screened through the microscopic examination, and albumin was screened through the strip. We summarized the descriptive statistic as frequency and percentage and for the statistical hypothesis used Chi-square test.

Results : Among the study participants, 62.8% were 10-14 years, and 37.2% were 15-19 years old. Of them, grade 6, grade 7, grade 8, grade 9, grade 10 were 18.6%, 18.4%, 21%, 22%, and 20%, respectively. The overall abnormalities of urine were 21.5%. Among the abnormalities, hematuria, urinary tract infection, and presence of albumin were 1.2%, 2.7%, 19.1%, respectively. In the association test between urine test with respondents' characteristics, only students' grade showed a significant (<0.001) association with overall urine test and albumin result. From the comparison of the grade percentages on overall urine test and albumin result, grade 8-9 have the highest percentage of abnormal categories (29.7% - 31%), follow by grade 10 (19.3% - 13.3%), and the lowest are grade 6-7 (9.2% - 13%).

Conclusion : We found from our study that there is a high prevalence of asymptomatic urinary abnormalities in school-going adolescent girls. Through this research findings, we propose a school-based screening program for the early detection of asymptomatic urinary abnormalities, which may help in reducing renal diseases and reproductive tract infections.

KEYWORDS Urinary abnormalities, Adolescent girl, Bangladesh.

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Impact of the COVID-19 pandemic on child immunization in Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Purpose : The COVID-19 pandemic has created interruptions in healthcare supply chains, impeded travel, and frightened of getting or dying from the virus, leading to severe global disruptions to healthcare services. Routine child immunization has affected most regions and high, low- and middle-income countries, particularly during the initial pandemic. We aimed to evaluate the initial impact of the COVID-19 pandemic on child immunization coverage in Bangladesh.

Methods : We used secondary data from Bangladesh's Directorate General of Health Services' real-time health information dashboard in this study. Between the period of 2019 and 2021, we gathered data on Bacillus Calmette Guérin (BCG), Pentavalent like Diphtheria, Pertussis, Tetanus, Hepatitis B, and Hemophilus influenzae type b (Penta)-1, Penta-3, Measles-Rubella (MR)-1, and MR-2, vaccinations for children under the age of 23 months. Since the first COVID-19 case was detected in Bangladesh on March 8, 2020, the lockdown was announced at the end of March, and we compared the April 2020 data with the same period of 2019 and 2021 to clarify the immediate impact of the outbreak. We analyzed regional data to determine a declining pattern at the division level and compared nationwide yearly vaccination coverages.

Result : In this study, we found intensely decreases in child immunization coverage rates in April 2020 compared to the same period of 2019 and 2021; for BCG (43.8% Vs 96.7%), Penta-1 (43.7% Vs 95.1%), Penta-3 (43.6% Vs 103.5%), MR-1 (45.2% Vs 95.1%), MR-2 (49.2% Vs 98.8%). In April 2020, the rate of decline in vaccine coverage between the greatest and lowest coverage regions were 48.1% for BCG, 52.6% for Penta-1, 52.1% for Penta-3, 54.7% for MR-1, 59.0% for MR-2. In addition, vaccination coverage was low while we compared nationwide yearly vaccination coverage rate between 2020 with the previous year 2019 and the next year 2021; (86.6% Vs 95.7%) for BCG, (85.3% Vs 95.0%) for Penta-1, (82.5% Vs 93.0%) for Penta-3, (81.7% Vs 92.7%) for MR-1, (80.5% Vs 90.4%) for MR-2.

Conclusion : Child immunization programs in April 2020 were drastically reduced in the early phases of the COVID-19 pandemic (when the lockdown started), and even in 2020, the immunization rate of children was lower than in previous and subsequent years, which might have a negative impact on vaccine-preventable disease (VPD) control in Bangladeshi children. It is essential to monitor vaccination coverage rates at the national and regional levels and determine who is left out or dropout in low coverage areas and take effective steps to prevent future VPD outbreaks. This research can support the preparedness for future epidemics of VPDs to public health authorities in Bangladesh.

KEYWORD Immunization, Child, COVID-19, Bangladesh



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Assessment of quality of life in cancer patients during the COVID-19 pandemic in Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
 Student presentation and posters

Background: A quality of life (QOL) is required for cancer patients for long-time survival. The COVID-19 pandemic impacts multiple areas of health-related issues, including cancer patients' quality of life. This study aimed to assess the quality of life of cancer patients at a tertiary hospital in Bangladesh during the COVID-19 pandemic.

Methods: A cross-sectional study was performed among 415 adult participants between January to April 2022 at a tertiary hospital located in Sirajgonj, Bangladesh. A self-reported EuroQol 5-Dimension 5-Level (EQ-5D-5L) questionnaire with socio-economic data was collected among the cancer patient. For the descriptive analysis, we used frequency and percentage. We also analyzed the Univariate Multinomial Logistic Regression of Anxiety and Depression (EQ 5D 5L) with socio-economic variables.

Result: In this study, 66% (272) were male, and 34% (143) were female. Respondent participants' age were ≤ 30 , 31-59, and ≥ 60 years as 19% (79), 62% (258), and 19% (78), respectively. Among the participants' mobility abilities were moderate 20% (81), severe to unable 23% (54), as well self-care were moderate 18% (75) and severe to unable 25% (61). On the other hand, the usual activities of the participants were moderate 19% (78) and severe to unable 19% (79), pain discomforts were moderate 34% (141) and severe to extreme 32% (132). The anxiety depression levels were moderate 30% (124) and severe to extreme 40% (167). We found statistically significant for both associations between those who were sufferer slight to moderate ($p = <0.001$) and severe to unable ($p = <0.001$) anxiety depression with whose income was less than 232.5 USD compared to those who earned more than 232.5 USD.

Conclusion: We found a significant association with the cancer patient's anxiety, depression, and economic factors, which is a large barrier to ensuring the quality of life in developing countries. It is essential to take initiatives through the government and private organizations for financial support and the health insurance system in reducing the financial burden and improving the QOL.

KEYWORD QOL, Cancer, COVID-19, Bangladesh.

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Prenatal toxic metals exposure and risk of preterm birth : a study from Agra region

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
 Student presentation and posters

The negative impact of metals in the environment on preterm delivery has become a major problem in the world and a leading cause of infant illness and mortality in past few decades. Epidemiological research into the association between maternal metal exposure and preterm birth, however, appears to be limited. As a result, a hospital-based case control study to assess metal levels in pregnant women was designed. For this study, a total of 200 pregnant women were recruited, with 80 females who delivered preterm babies (<37 weeks of gestation) and 120 females who delivered full-term babies (>37 weeks of gestation) serve as the study group and control group, respectively. After delivery, placenta samples were collected from relevant mother-and-singleton offspring pairs at Medical College in Agra, and metal levels such as lead (Pb), cadmium (Cd), arsenic (As), aluminium (Al), nickel (Ni), chromium (Cr) analyzed with help of ICP-OES. The findings revealed that toxic metal levels, such as Cd, As and Pb, were significantly higher in the study group compared to the control group. After controlling potential risk variables for preterm delivery, logistic regression analysis revealed a significant link between Pb (OR=1.31, 95% CI: 0.1, 0.2, 0.159, As (OR=1.66, 95% CI: 1.23, 1.89) and Cr (OR=1.39, 95% CI: 0.54, 2.85) and risk of early pregnancy. Moreover, PCA analysis revealed that biomass fuel combustion, eating behaviours, and drinking water sources were major sources of exposure for the study population. Finally results revealed that toxic metal levels, such as As, Pb and Cr increases risk of early pregnancy.

KEYWORDS Placenta, Metals, Environment



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Assessing the risk of deltamethrin and cadmium (Cd) on terrestrial species *Tenebrio Molitor* as model test

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Background : Deltamethrin is one the most extensively applied type II pyrethroid in agriculture and to combat noxious insects or pests in households to date. Cadmium (Cd) as representative of metals is fit to study metal uptake. Less study was detected on the two compounds on terrestrial arthropods' effect. The present study explores the toxicity of deltamethrin and cadmium on *Tenebrio molitor* (mealworms) by identification on both weight (or growth) and survival rate of the species.

Method : Toxicity test was carried out in the laboratory through an independent experiment with some adjustments. The mealworms were at instar 12th-14th exposed to a series of contaminated oatmeal for 13 days, of which the applied concentration was 4 mg/kg oatmeal.

Results : On deltamethrin, the larvae lost a significant weight up to 0.95 ± 0.09 , and the mortality rate up to 43%. In tune with the higher dosages, deltamethrin significantly promoted not reactive (80%), immobile (80%), and dead larvae (over 40%). By multinomial logistic regression, the R2 coefficient confirmed 65.1% of the variability of the symptoms can be explained by deltamethrin ($p=0.000$). Unfortunately, on Cd, it seemed that there was no significant effect discovered in both the weight and mortality rate of the larvae. One to be confirmed R2 coefficient testified that 68.7% of the cases were influenced by other factors outside of Cd.

Conclusion : Deltamethrin gives a risk on larvae' growth (weight) & survival rate whilst it is not applicable for Cd. It is notable to consider water source types that seem to promote healthy larvae, the larval instar, and the urgency of the application of positive control in the experiment.

KEYWORD Risk Assessment , *Tenebrio molitor*, deltamethrin, Cd

Occurrence, removal and risk assessment of organic micropollutants in wastewater treatment plants in South Korea

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Due to the large-scale production and use of synthetic chemicals, various chemicals are found in the aquatic environment, which are often termed as organic micropollutants (OMPs). Effluents of municipal wastewater treatment plants (WWTPs) have been identified as one of major sources of theses OMPs. In this article, the current status of occurrence and removal of OMPs in four WWTPs in Korea, as well as their potential risk on receiving water quality were investigated. Pharmaceuticals such as metformin, acetaminophen, caffeine, ibuprofen, cimetidine, and naproxen were found at concentrations of more than 1 ug/L in the influents. Most OMPs were not removed by the primary treatment (removal < 10%), while the secondary biological treatment was mainly responsible for the removals of the OMPs. Among the four biological treatment processes (CAS, MLE, A2O, A2O-MBR), A2O-MBR process showed relatively high removal efficiencies for all OMPs. On the other hand, the disinfection processes (chlorination and UV) showed relatively low removal efficiencies. The median concentrations in the final effluents were more than 0.1 ug/L for metformin, cimetidine, diclofenac, naproxen, carbamazepine, iopromide, benzotriazoles (BTR, 4TTR), and DEET. Considering the effluent concentration, detection frequency, biodegradability, bioaccumulation factor, and toxicity, DEET, 4TTR, propranolol, iopromide, cimetidine, diclofenac were found to have some negative impact on the receiving water quality.



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Community engaged child faeces management (CFM) reduced disease outbreak : experience from WaterAid in Bangladesh

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Background : Bangladesh is a cholera endemic country with high disease burden. An estimated 100,000 cholera cases are annually reported while a population of 66 million are at risk nationally with an annual incidence rate upto 2/1,000 population suggesting of 450,000 hospitalized cases and over 1 million infections per year.

Bangladesh made significant progress in awareness raising and infrastructure improvement for sanitation through CLTS (Community Led Total Sanitation), but in child feces management (CFM), people seem quite ignorant, while child feces are equally harmful. In 2006, only 22% of households reported disposal of child feces into latrines, i.e.; feces of 7.5 million children were not disposed safely.

Interventions : Meherpur, a district in the south-west Bangladesh, has been a diarrhea prone area and hence one of the hotspot-zones. In 2015, an outbreak occurred where over 1,000 people including children got affected. WAB designed and implemented a comprehensive project with a particular focus on CFM including basic hygiene practices. The project developed awareness among the mothers' of under 5 children through community sessions, household (HH) visits and encouraged them to use child friendly defecation devices (potty). The project developed context specific behavior change communication modules and flip charts; deployed and trained WASH promoters to promote awareness and encourage people to follow good practices and hygiene behavior.

Results : During April 2017 to August 2019, in Meherpur, the project organized 4,580 sessions on hand washing (HW) to reach and orient 382,192 people; 516 sessions conducted on CFM to reach 6,159 people and 697 potties were acquired by the households of under-five children for managing child feces. Following the sessions, targeted mothers and caregivers are using potty in a safely manner. The outbreak incidence reports from IEDCR/MoH shows, in 2015 and 2016, two outbreaks happened in Meherpur, but no such incidence was recorded there for last 5 years.

Conclusions : Cholera is an endemic disease and CFM has potential impact on reducing cholera and related gastro-intestinal disease spread. CFM requires community engaged interventions rather than only tools or vaccines. Thus, WASH and CFM can significantly alter the spread of cholera; and is the most important tools for long-term sustainable cholera control and elimination programs.

The emerging concepts of sustainability and sustainable chemistry

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

The climate negotiations have now reached a stage when 'Net Zero' pledges are being made by more and more countries. The target of achieving net zero emissions of greenhouse gases, especially CO₂ by 2050 are more likely to be missed by a wide margin, yet remarkable changes will take place in the meanwhile with regard to energy transition moving away from carbon as far as possible. The transition called for will bring unprecedented changes not only with regard to technology for manufacture, distribution and transportation of products and processes but also in many other spheres of human activities concerning law, ethics, international trade as well as consumption with 'sustainability' at the centre stage. Key scientific pursuits, especially in chemical research will be turned into industrial practices which fit into the criterion of 'sustainability'. Products will be designed and produced based on the principles of 'circular economy' that can be used for a long time and/or recycles, repaired and reused without the need for disposal. Sustainable development goals of the United Nations will be pursued to be achieved with greater vigor than before. Eventually, sustainability needs to be rooted in the societal, environmental, economic and scientific fields as well as in cultural understanding. Public perception would change towards consumption of goods that are clearly 'sustainable'.



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Detection of endocrine disruptors bisphenol A and bisphenol B in Bangladeshi thermal receipt papers

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Bisphenol analogues such as bisphenol A (BPA), a high production volume chemical identified as an endocrine disruptor and toxic to reproduction are mainly used in the thermal receipts papers as a color developer. Due to its effects on health and legal restrictions, BPA is increasingly replaced by other bisphenols such as bisphenol S (BPS). In this study, BPA and four alternatives including BPS, Bisphenol F (BPF), Bisphenol B (BPB), and Bisphenol AF (BPAF) were analyzed in thermal paper cash receipts using a sensitive LC-MS/ MS method. The cash receipts contained almost only BPA and BPS, whereas BPA was found in 67.5% of the samples at a concentration ranging from 0.83% to 1.71%. BPS was detected at lower concentrations than BPA, found in 25% of samples at a concentration ranging from 0.61% to 0.96%. Both of the substances exceeded the EU limit in the thermal receipt paper of 0.02% per weight. No other analogues were detected from any of the samples analyzed here. As the levels identified are higher than the legal limits of the EU regulations, we should develop regulatory rules and restrictions on the use of bisphenols in cash receipts in Bangladesh.

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Health, environment, and economic impacts of climate change and adaptations in Indonesia

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

The climate change is a global concern that needs to be considered for Indonesia as an archipelagic nation, that will be impacts on human health. The consequences of disturbances of natural and managed food-producing ecosystems, rising sea-levels, and population displacement in Indonesia, not yet studied deeply. This paper discusses a set of health, environment, and economic impact of climate change and adaptation in Indonesia. The environment impacts of climate change are included the increasing frequency of natural disasters (floods, landslides, windstorms, landslides, floods, droughts, tropical storms); increasing air pollution; reducing water availability; seasonal shifts and changes in rainfall patterns; increasing temperature and risk of forest fires; destruction of biodiversity; rising sea level and waves; damaging of infrastructure in coastal areas; and emerging of new pests and diseases and increasing attacks of agricultural pests and diseases. The health impacts of climate change are included the increasing vector borne diseases (malaria, dengue, filariasis); increasing water borne diseases (diarrhea, cholera, typhoid, leptospirosis); increasing malnutrition; increasing cardiovascular diseases, hypertension, and mental disorders; increasing respiratory diseases (influenza, asthma, pneumonia); and increasing food borne diseases.

The impacts of climate change on the economy are included the loss of agricultural productivity; increasing costs for repair of environmental damage; increasing costs for air quality restoration; increasing costs of food production and supply; increasing health costs due to disease related to climate change; increasing costs for drinking and clean water; lost productivity due to illness and death related to climate change; lost productivity due to reduced tourist visits to areas affected by climate change.

The adaptation of climate change in Indonesia are included the advocacy and promotion on climate change adaptation; mapping of populations at risk; improving of climate change response systems; improving clean and drinking water; improving health system (health workforce, diseases surveillance, and affordability health services); improving diseases control and prevention systems (water-borne, vector-borne, and food-borne diseases); increasing partnerships with various parties; increasing community empowerment; construction of embankments and planting of mangrove trees; cultivating seaweed, crabs, milkfish, and shrimp in coastal communities; and changing farming habits in the agricultural sector.

KEYWORDS climate change, Indonesia, health impacts, economic impacts, adaptations



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Bioextraction of arsenic from polluted soil by indigenous microbes and *Shewanella putrefaciens*

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Student presentation and posters

We investigated the removal of As from arsenic-contaminated soils using an iron-reducing bacterium *Shewanella putrefaciens* and indigenous bacterial consortium. Sequential extraction of As revealed that more than 30% of As was associated with Fe(III)-(oxy)hydroxides in the soil. The results indicated that the increase in bioreduction of Fe(III) resulted in the increase of dissolved As from the soil. The highest As removal (57.5%) was obtained from the combination of *S. putrefaciens* and indigenous bacterial consortium. When pure *S. putrefaciens* and indigenous bacterial consortium were applied to the soil, 30.1% and 16.4% of As were extracted from the soil, respectively. Sequential extraction analysis showed that As which had been bound with Fe-Mn fractions in the soil was efficiently reduced by microbes. After application of the microbial leaching technique, the preservation of soil quality was confirmed when compared with the initial soil. Our results suggested that the ecological and physiological understanding of the indigenous microbiome might be important for the efficient application of bioleaching technology to remove As from contaminated soils.

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Providing safe drinking water through nanofiltration membrane water-purifying device to villages vulnerable to climate change in Laos

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

In Laos, the Mekong River basin has been widely distributed in the country and used as a major water source. However, it is vulnerable to safe access to drinking water due to natural disasters caused by climate change. In particular, in 2018, a dam in a tributary of the Mekong River in southern Laos collapsed, causing flood damage in some villages in Attapeu Province, located downstream, resulting in thousands of victims. Many people in Attapeu are still living in poor refugee camps due to insufficient infrastructure and delayed damage recovery. In addition, refugee camp residents are threatened by river flooding and potential arsenic exposure from frequent rain due to climate change. This project aims to provide clean and sustainable drinking water by installing the Nanofiltration Membrane Water Purifier in the villages in Attapeu, Laos. Our purifier is based on the simple physical separation technology that pressurizes contaminated water to obtain clean water. The purifier can be operated without any electrical power and is easy to use without heavy maintenance for a long period. In the preliminary experiment, it was confirmed that the contaminated water passed through the water purifier to remove arsenic and bacterial contaminants. Therefore, it is suitable for the Attapeu residents who use arsenic-contaminated water as the drinking water source. Three purifiers are installed in different villages in Attapeu, and their removal ability is continuously checked.



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Health-related air quality monitoring in urban and peri-urban areas in Solomon Islands and Fiji : A first time glimpse of trends through continuous measurement

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

We propose to show outcomes from the first continuous real time multi-year Air Quality (AQ) measurement dome in Pacific Island Countries (PIC).

WHO considers air pollution a health emergency, responsible for millions of premature deaths annually. While over time AQ has been deteriorating in PIC cities such as Suva in Fiji – where there is evidence of AQ being poor, most PIC don't monitor health-related AQ.

Our Consortium for Pasifika Air Quality and Environmental Health started AQ measurement in Fiji and Solomon Islands in Nov 2018, using stationary continuous air sensing measurement of Particulate Matter (PM) 2.5. We will present data that show PM2.5 levels substantially exceeding WHO Guidelines, implying health risks for local populations. These results strongly indicate that country-level monitoring of health-related AQ is much needed. We are currently broadening research-based health-related AQ measuring for PIC, by expanding the program to Tonga and Vanuatu. We will also show why expanding the AQ monitoring regime will provide risk and impact assessment with lower uncertainty.

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Tunable efficiency of nanocomposites for remediation of hazardous waste water and environmental pollution

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Student presentation and posters

Environmental pollution such as contaminated water or polluted air or global warming has become a major issue of concern throughout the world. The common pollutant sources are toxic organic molecules or gas compounds which are released from household waste and industries. Maximum water pollution is generated from organic waste such as dyes, phenols, pesticides, fertilizers, toxic chemical, detergents and other chemical products that are disposed directly into water or environment. Organic chemicals must be removed or destroyed before their discharge to the environment. Photocatalysis is one of the most important techniques for decomposition of various hazardous chemicals, waste water and organic pollutants. The greatest significance of this technique is that it can degrade various organic chemicals that could not be degraded by other methods of purification. One can achieve significant improvement of photocatalytic activity efficiency in solar region by modification of metal oxide semiconductor surface with doping of noble metals. Noble metals nanoparticles are commonly used nanomaterials for improving the sensing performance of surface plasmon resonance sensors. Surface plasmon resonance exhibit strong absorption corresponding to excitation wavelength regions. Consequently, a large electric field due to surface plasmon resonance is excited on the surface of the nanoparticles. The surface plasmon resonance sensitivity is closely related to the excited electric field. Therefore, larger the electric field has more sensitive of surface plasmon resonance sensors to the change of its surrounding medium. This can help in increased stability and trapping capability of plasmonic nanoparticles that will boost the development of numerous applications in science and technology.



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Hazards of water pollution

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

The mistreatment of water resources and release of untreated industrial and municipal toxic effluents has led Pakistan towards environmental, social and economic problems. The contaminated water has become a serious threat to human, wild and aquatic life. Pakistan is left with very limited sources of fresh drinking water due to rapidly increasing human population and industrialization. About 20% of the whole population of Pakistan has access to safe drinking water. The remaining 80% of population is forced to use unsafe drinking water due to the scarcity of safe and healthy drinking water sources. Anthropogenic activities cause waterborne diseases that constitute about 80% of all diseases and are responsible for 33% of deaths in Pakistan. According to the study of The Pakistan Council for Research in Water Resources (PCRWR) 65% of groundwater samples were contaminated with total coliforms and 35% were contaminated with E.coli. They also confirmed the contamination of surface waters with these bacteria drastically. This situation has posed a serious risk to the public health. The pathogenic microbes in drinking water are major cause of waterborne diseases like diarrhea, nausea, typhoid, dysentery, and other health problems. The presence of endocrine disrupting compounds released from industrial and municipal waste is directly impacting human and aquatic life. Waterborne diseases have been the cause of a mortality rate as high as 128/1,000 per year, and about 230,000 infants (below the age of 5 years) in Pakistan die every year due to waterborne diseases. According to other estimates, more than three million people in Pakistan are suffering from diseases due to low-quality water, out of which 0.1 million lose their lives every year. Approximately 70 % of the drinking water supplied by the government authorities in Pakistan is not safe and is responsible for many serious waterborne diseases.

Water recovery from industrial hazardous category effluent

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Water is becoming a scarce commodity for drinking and green development due to inadequate public water supply and depletion of ground and surface water sources. With a view to overcome the quality water shortage and sustainable development on clean and green environment, water recovery from domestic and industrial wastewater is becoming mandatory in many states in India. The management of high salinity and Total Dissolved Solids (TDS) in ground water and industrial effluent treatment are becoming major environmental and technical challenges.

With an aim to overcome this problem advanced oxidation treatment using ozone and membrane system have been developed and adopted in industrial effluent treatment system to control turbidity, colour and TDS for recovery of quality water. Segregation of streams, adoption of improved Cleaner Production Process, Recovery of Chemicals such as Chrome Recovery and Reuse systems have been developed in individual industrial units prior to the upgradation and adoption of Zero Liquid Discharge (ZLD) in Common Effluent Treatment Plants (CETPs) with water recovery.

The various stages treatment system in CETPs are (i) Conventional physiochemical and biological effluent treatment systems to reduce BOD less than 20mg/l, COD less than 250mg/l, Suspended Solids less than 50mg/l etc. and (ii) Tertiary treatment systems such as micro-filter, ultra-filtration and advance oxidation system using ozone treatment to reduce turbidity, colour and suspended solids less than 5mg/l. The two stage Reverse Osmosis (RO) system with high pressure membrane reduces TDS level less than 500mg/l. About more than 80% quality water is recovered from industrial waste water. The saline reject with TDS more than 30000mg/l is evaporated using Multiple Stage Evaporator (MEE) and the recovered salt is further clarified and planned for industrial applications.

During the recent times, many technological innovations such as advanced oxidation using ozone have been developed and implemented in many CETPs with recovery of water under ZLD with huge investment of more than 500 million US dollars by the hazardous category industries such as tanneries, textile units, chemical processing industries, etc. mainly in South India.

KEYWORDS Water recovery, Hazardous waste, Treatment, Zero Liquid Discharge



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Environmental hazards of fluoride in drinking water : Health impact on children & adults and control measures

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

The quality of water has become a major global concern in the context of depleting resources. Children especially infants drink more fluid per kilogram of body weight than adults. The immune system of children is not fully developed to fight against contaminants in drinking water. The contaminants in drinking water may affect learning skills, intelligent quotient and sex hormones during the important stages of growth. Natural water quality issues such as certain heavy metals, arsenic and fluoride have received significant attention. Among them fluoride is the principal and dangerous toxic substance to the foetus, infants and children below the age of 12. Many children are affected with fluorosis worldwide and an estimate 6 million children are afflicted with endemic fluorosis in India. World Health Organization (WHO) sets a permissible level of 1.5 mg/L of fluoride in drinking water as standard taking into account the potential impact of fluoride on children health. The prolonged intake of high fluoride combined with nutritional deficiency through water, food and air leads to various health defects not only for children but also for adults. These defects are classified as dental, skeletal and non-skeletal fluorosis. Mottling of teeth in children is one of the earliest and most easily recognized features of fluorosis. Later stages, the teeth will be pitted, perforated and may even get chipped off and there is also premature loss of teeth. Higher intake of fluoride particularly by children causes skeletal deformities. Non-skeletal fluorosis affects soft tissues like ligaments, muscles, red blood cells, blood vessels and gastrointestinal systems. Several governmental and non-governmental organizations are working against fluorosis and its related health hazards. United Nations Children's Fund has been working closely with the government of India to assess safety conditions and implementing specific fluorosis mitigation programmes. UNICEF accords high priority to fluoride toxicity over children health. Government of India established national fluorosis control cell to implement human resource development involving training of medical and paramedical staff and awareness generation among grass-root level functionaries. Rajiv Gandhi National drinking water mission decided to support the establishment of water testing laboratories in each district. Under this programme, the ministry of rural areas and employment, which is the nodal organization for providing safe water, has laid emphasis on water quality through removal of excess fluoride in water. The Indian government annual outlay for providing safe drinking water has been substantially increased. Considering the toxic effect of fluoride and in particular the health hazard of children, it is necessary to remove the excess fluoride from drinking water. This research paper focuses the salient features of fluoride related health hazards of children and effective remedial measures. The scientific facts reported in this paper reveal the effectiveness of the low cost fluoride removal technique based on domestic defluoridation filters for drinking water supply in rural areas at affordable cost.

Ecotourism and bio-diversity : South Asian perspective

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Student presentation and posters

Eco-friendly practice is not much popular amongst the citizens of South Asia. Especially, when it comes down to the tourism sector, we can see that eco-friendly practices are even less among both tourists and tour guides. Our paper focuses on problems caused by the current practices in consumption and production by the general public and how these affect the ecological balance, especially between ecotourism and biodiversity. Also, this paper highlights the underlying causes behind these practices and suggests some remedial measures so that we can replace these activities with eco-friendly practices. The paper also stresses on the importance of using eco-friendly products which implies both sustainable production and consumption, and the impacts of programs like "Green Key" offered by the Foundation for Environmental Education (FEE).



Amara M. Kamara

Youth leadership in the time of climate crises

The 19th International Conference of the Pacific Basin Consortium for Environment and Health (PBC)
Student presentation and posters

Plastic waste materials are causing devastating environmental conditions and resulting in harm to the well-being of the Front street community. Ecological resources in our community are constantly polluted by discharged and unwanted plastic substances. The increase in the use of plastic is due to the lack of a system that constantly exposes our environment to climate change. Policymakers are not putting enough effort to cascade these climate risks. Research has shown that in Africa From 1997 to 2017 Uganda imported 1.9 million tons of plastic, which has increased by six-fold over the last three years which has created extra pollution and made life difficult for well-being, animals, and our environment (Wandeka et al, 2022) It is estimated that every year 2.41 million tons of plastic waste is being carried by the river to the seas, and ocean which is causing problems for our marine organisms, including strangulation, malnutrition, and death (Kurtela and Antolović, 2019) Climate change is happening now, and it is the greatest threat to our planet, cost-effective, and ambitious solutions are urgently required to provide mitigating solutions. In the effort for world climate leaders to help strengthen countries' abilities to deal with and solve global climate crises, young people cannot be exempt from the mitigating process. Although they are always the victims, they should be involved in problem-solving. Youths are leaders, and they cannot avoid responsibility for participating in civil society, preserving their local communities, and serving national interests. They should gain power, devise policies, and make crucial local and national choices as time goes on. Reform- Africa, the Liberian Youth for Climate Action is doing amazing work to maintain the natural ability of our ocean, and forest. What has become obvious, a youth-led initiative helping to combat climate change has received little attention from world leaders, and there is an inadequate support base system to help these emerging leaders fulfill their potential, and be able to scale, and increase impact. If more youth-led initiatives are supported to join the movement of cascading global climate risk, the Paris agreement to limit global warming to well below 2° C. and pursuing an effort to limit it to 1.5°C will be achieved.



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