2021

President's Awards for Scientific Research

National Research Council

Sri Lanka

December 2025

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Message from the President of the Democratic Socialist Republic of Sri Lanka

It gives me immense pleasure to extend my warm congratulations to all recipients of the President's Awards for Scientific Research. This prestigious national recognition is a testament to your outstanding scholarly achievements and your valuable contributions to the advancement of knowledge through scientific research.

Scientific inquiry and innovation form the cornerstone of a nation's sustainable development. The research contributions recognised today reflect not only academic excellence, but also dedication, perseverance, and a deep commitment to addressing challenges of national and global significance. Your work strengthens Sri Lanka's standing in the international scientific community and contributes meaningfully to evidence-based policymaking, technological advancement, and societal well-being.

I commend the National Research Council of Sri Lanka (NRC) for its continued leadership in promoting a vibrant research culture and for administering the President's Awards for Scientific Research with integrity and rigour. Since its inception, this programme has played a vital role in recognising merit and encouraging excellence among our scientific community.

I also take this opportunity to acknowledge all Sri Lankan scientists and researchers whose sustained efforts continue to enrich our national research ecosystem and inspire future generations.

I extend my best wishes to all awardees for continued success in your academic and professional endeavours, and I am confident that your contributions will continue to support Sri Lanka's journey towards a knowledge-based and innovation-driven economy.

Anura Kumara Dissanayake
President
Democratic Socialist Republic of Sri Lanka
16th December, 2025

Message from the Hon. Minister of Science and Technology

It is my pleasure to congratulate the recipients of the President’s Awards for Scientific Research 2021. This national honor celebrates scientific excellence, dedication, and innovation, and recognizes the vital contributions of our researchers to national progress and global knowledge.

Scientific research forms the backbone of informed policy, technological progress, and sustainable growth. The achievements recognized through these awards demonstrate how dedication, creativity, and discipline can generate solutions to national challenges and create meaningful societal impact.

The Ministry of Science and Technology is committed to strengthening the research ecosystem by supporting institutions, promoting collaboration, and nurturing talent. We are focused on increasing funding, improving infrastructure, and encouraging research that addresses national priorities and supports sustainable development. I am confident our scientists will drive progress and help position Sri Lanka as a knowledge-based nation. I also acknowledge the institutions, mentors, and collaborators who supported these achievements. May this recognition inspire ongoing excellence and motivate future generations to pursue scientific inquiry for the nation’s benefit.

The perseverance and curiosity of President's Awards for Scientific Research awardees inspire young scientists and students nationwide. You embody the spirit of innovation Sri Lanka needs to compete as a knowledge-based nation. I encourage you to keep striving for excellence, mentor the next generation, and engage with industry and society to maximize your impact.

As we celebrate these achievements, let us work together to build a future where research and innovation drive national prosperity and well-being.

I extend my best wishes to all awardees and thank everyone who contributed to making this event a meaningful celebration of scientific excellence.

Emeritus Professor Chrishantha Abeysena
Hon. Minister, Ministry of Science and Technology

Message from the Chairperson, National Research Council

It is with great pride and deep appreciation that I extend my warmest congratulations to all the recipients of the President's Awards for Scientific Research 2021. These awards stand as a testament to the dedication, intellectual rigor, and unwavering commitment of Sri Lanka's research community, whose work continues to elevate the nation's standing in science, innovation, and thereby development.

Your contributions, whether advancing fundamental understanding, addressing national health and development challenges, or strengthening technological and social innovation, play an essential role in shaping a more resilient and prosperous future for our country. Now more than ever. The achievements celebrated today reflect not only individual excellence but the collective spirit of inquiry and perseverance that define our research ecosystem.

In addition to all award winners, the NRC celebrates and commends all scientists whose dedication and hard work are elevating our country to new heights. Together, we are making a difference!

As Chairperson of the National Research Council, I express my sincere gratitude to the researchers, institutions, mentors, collaborators, and partners who make this progress possible. I also encourage you to continue pushing boundaries, engaging in meaningful multidisciplinary work, and translating evidence into impactful solutions.
May your accomplishments inspire the next generation of scientists and reaffirm our shared belief that knowledge, when nurtured and applied, holds the power to transform society. Moving beyond individual achievements, I would urge our eminent researchers to reflect on science in its completeness—its purpose, its responsibility, and its contribution to society.

I wish to place on record my heartfelt appreciation for the unwavering support of the Ministry of Science and Technology, Sri Lanka, whose vision inspires research. My gratitude also extends to the professional bodies, the many agencies, and the NRC staff, whose encouragement and tireless efforts have made not only this event but countless breakthroughs possible. I am deeply grateful to our Guests of Honour, the distinguished Key note speaker, and each award winner—your achievements stand as a beacon of inspiration for us all. As we celebrate today, let us remember: it is your dedication, curiosity, and courage that shape the future. Together, we are building a legacy of discovery and progress.
My heartfelt congratulations once again, and I wish you continued success in all your future endeavours.

Prof. Anuji Gamage
Chairperson, National Research Council

Abstract of the Keynote Speaker, Prof. Buddhi Marambe

Senior Professor, Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka, President - Weed Science Society of Sri Lanka (WSSSL), Chairman, National Invasive Species Specialist Group (NISSG), Ministry of Environment, Member. National Experts Committee on Climate Change Adaptation (NECCCA), Ministry of Environment , Editor - Sri Lanka Journal of Food and Agriculture (SLJFA) https://sljfa.sljol.info/

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Advancing Research on Climate Change, its Impact and Climate Action in Sri Lanka

Sri Lanka is highly vulnerable to climate change due to its geographic location, tropical climate, and strong dependence on climate-sensitive sectors. Climate change research is therefore critical for understanding evolving temperature and rainfall patterns, increasing climate variability, extreme weather events, and sea-level rise, and their cascading impacts on climate-sensitive sectors, including, but not limited to, agriculture, tourism, water resources, biodiversity, and public health. Robust scientific evidence enables the identification of risks, vulnerabilities, and sector-specific adaptation needs, supporting informed decision-making at national, sectoral, and local levels.

In the agricultural sector, climate change research highlights growing risks from droughts, floods, heat stress, and shifting monsoon patterns that threaten crop productivity, food security, and rural livelihoods. In tourism, research reveals increasing threats to coastal and nature-based destinations from sea-level rise, coastal erosion, coral bleaching, biodiversity loss, and climate-induced disasters, underscoring the need for climate-resilient tourism planning and sustainable destination management. Water resources research demonstrates how climate change intensifies water scarcity, seasonal variability, and water quality challenges, affecting domestic supply, irrigation, hydropower, ecosystem health, and disease transmission pathways.

Health-focused climate research indicates rising risks from heat stress, vector-borne and water-borne diseases, malnutrition & under-nutrition, and climate-related disasters, particularly among vulnerable populations. Integrating climate and health research supports early warning systems, resilient health infrastructure, and preventive public health planning. Biodiversity research further shows that climate change accelerates habitat degradation, species loss, and ecosystem fragmentation across Sri Lanka's forests, wetlands, and marine ecosystems, weakening ecosystem services that support livelihoods, tourism, food systems, and health outcomes.

Recent extreme events such as **Cyclonic Storm *Ditwah*** underscore the urgent need for strengthened climate change research in Sri Lanka. *Ditwah* caused widespread heavy rainfall, flooding, loss of human and animal life, infrastructure damage, agricultural losses, ecosystem disruption & biodiversity loss, and public health risks, demonstrating how climate hazards can generate cascading socio-economic impacts. While the influence of climate change on individual cyclones remains complex, research indicates that warming sea surface temperatures and climate variability can intensify rainfall associated with such systems. The impacts of *Ditwah* highlight critical knowledge gaps in extreme rainfall attribution, early warning systems, impact forecasting, and sectoral risk assessments, reinforcing the need for targeted, interdisciplinary climate research to support preparedness, response, and recovery.

Climate change research in Sri Lanka must be strategically aligned with national policy frameworks, including the National Policy on Climate Change of 2023, the National Adaptation Plan (currently updated), Provincial Adaptation Plans (nearing completion), updated Technology Needs Assessment (TNA) and Technology Action Plan (TAP), the third iteration of Nationally Determined Contributions 2026-2035 (NDC 3.0), Climate-smart Green Growth Strategy and Investment Plan 2025-2050, Carbon Net Zero 2050 Roadmap and Strategic Plan, and the National Climate Finance Strategy of Sri Lanka (2025-2030). These frameworks provide strategic guidance for prioritizing research, addressing policy-relevant knowledge gaps, and supporting the implementation, monitoring, and reporting of adaptation and mitigation actions. Policy-aligned research strengthens cross-sectoral coherence and ensures that scientific evidence directly informs planning, investment, and governance processes for effective and equitable climate action.

Criteria for President's Awards for Scientific Research

Each award will be given for a published work rather than to an individual scientist, and all Sri Lankan co-authors with a Sri Lankan institutional affiliation of the publication will be recognized as recipient of the award. The journal ranking system (on the basis of which the best scientific work will be selected) will be source normalized based on weighted citation to avoid bias towards any scientific discipline, and will be available in the public domain. Recognition will be given to research with a significant contribution by Sri Lankan scientists working in Sri Lanka.

Present Criteria for President's Award for Scientific Research

Each year, an award will be given to each of the top 150 papers published in journals with the highest SCImago Journal Ranking (SJR), in which 20% or more of the authors of the publication are Sri Lankan scientists with a Sri Lankan institutional affiliation.

OR

to each International Patent (published/granted) based on an innovation in science awarded in a given year, to a Sri Lankan Scientist(s) with a Sri Lankan affiliation.

Abstracts – 2021 Publications

Survey on Multi-Access Edge Computing Security and Privacy

IEEE Communications Surveys and Tutorials, Vol 23, Iss 2, pp 1078 – 1124

Pasika Ranaweera, Anca Delia Jurcut, Madhusanka Liyanage

Abstracts

The European Telecommunications Standards Institute (ETSI) has introduced the paradigm of Multi-Access Edge Computing (MEC) to enable efficient and fast data processing in mobile networks. Among other technological requirements, security and privacy are significant factors in the realization of MEC deployments. In this paper, we analyse the security and privacy of the MEC system. We introduce a thorough investigation of the identification and the analysis of threat vectors in the ETSI standardized MEC architecture. Furthermore, we analyse the vulnerabilities leading to the identified threat vectors and propose potential security solutions to overcome these vulnerabilities. The privacy issues of MEC are also highlighted, and clear objectives for preserving privacy are defined. Finally, we present future directives to enhance the security and privacy of MEC services.

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Hospital presentations for self-poisoning during COVID-19 in Sri Lanka: an interrupted time-series analysis

The Lancet Psychiatry, Vol 8, Iss 10, 892-900

Duleeka Knipe, Tharuka Silva, Azra Aroos, Lalith Senarathna, Nirosha Madhuwanthi Hettiarachchi, Sampath R Galappaththi, Matthew J Spittal, David Gunnell, Chris Metcalfe, Thilini Rajapakse

Summary

Background

There is widespread concern over the impact of public health measures, such as lockdowns, associated with COVID-19 on mental health, including suicide. High-quality evidence from low-income and middle-income countries, where the burden of suicide and self-harm is greatest, is scarce. We aimed to determine the effect of the pandemic on hospital presentations for self-poisoning.

Methods

In this interrupted time-series analysis, we established a new self-poisoning register at the tertiary care Teaching Hospital Peradeniya in Sri Lanka, a lower-middle-income country. Using a standard extraction sheet, data were gathered for all patients admitted to the Toxicology Unit with self-poisoning between Jan 1, 2019, and Aug 31, 2020. Only patients classified by the treating clinician as having intentionally self-poisoned were included. Data on date of admission, age or date of birth, sex, and poisoning method were collected. No data on ethnicity were available. We used interrupted time-series analysis to calculate weekly hospital admissions for self-poisoning before (Jan 1, 2019–March 19, 2020) and during (March 20–Aug 31, 2020) the pandemic, overall and by age (age <25 years vs ≥25 years) and sex. Individuals with missing date of admission were excluded from the main analysis.

Findings

Between Jan 1, 2019, and Aug 31, 2020, 1401 individuals (584 [41·7%] males, 761 [54·3%] females, and 56 [4·0%] of unknown sex) presented to the hospital with self-poisoning and had date of admission data. A 32% (95% CI 12–48) reduction in hospital presentations for self-poisoning in the pandemic period compared with pre-pandemic trends was observed (rate ratio 0·68, 95% CI 0·52–0·88; p=0·0032). We found no evidence that the impact of the pandemic differed by sex (rate ratio 0·64, 95% CI 0·44–0·94, for females vs 0·85, 0·57–1·26, for males; $P_{interaction}$=0·43) or age (0·64, 0·44–0·93, for patients aged <25 years vs 0·81, 0·57–1·16, for patients aged ≥25 years; $P_{interaction}$=0·077

Interpretation

This is the first study from a lower-middle-income country to estimate the impact of the pandemic on self-harm (non-fatal) accounting for underlying trends. If the fall in hospital presentations during the pandemic reflects a reduction in the medical treatment of people who have self-poisoned, rather than a true fall in incidence, then public health messages should emphasise the importance of seeking help early.

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Case fatality of agricultural pesticides after self-poisoning in Sri Lanka: a prospective cohort study

The Lancet Global Health, Vol 9, Iss 6, pp E854-E862

Nicholas A Buckley, Mohamed Fahim, Jacques Raubenheimer, Indika B Gawarammana, Michael Eddleston, Michael S Roberts, Andrew H Dawson

Summary

Background

Pesticide poisoning is among the most common means of suicide globally, but can be prevented with regulation of the most hazardous agents. We aimed to compare the lethality of pesticides ingested by our cohort, seek evidence on variation between human and regulatory animal toxicity, and establish change over time in the case fatality of individual pesticides in Sri Lanka.

Methods

We examined the case fatality of agricultural pesticides in a prospective cohort in nine hospitals serving rural populations in Sri Lanka. We included all patients (>11 years) who had presented to a South Asian Clinical Toxicology Research Collaboration study hospital during the study period. Patients were enrolled by clinical research assistants and were regularly reviewed. Identification of the ingested pesticide was generally on the basis of history or positive identification of the container, supported by nested blood analysis.

Findings

From March 31, 2002, to Dec 31, 2019, 34 902 patients (median age 29 years [IQR 21–40]; 23 060 [66·1%] male) presented with a possible or known pesticide self-poisoning. We identified 23 139 specific pesticides that were ingested. Poisoning was fatal in 2299 (6·6%) patients. Case fatality varied greatly from 0·0% (several substances) to 41·8% (paraquat). The three most toxic agents (ie, paraquat, dimethoate, and fenthion) were banned between 2008 and 2011. Since 2013, the five agents causing the most deaths (ie, profenofos, propanil, fenobucarb, carbosulfan, and quinalphos) had a case fatality of 7·2–8·6%. A steady decline was seen in overall case fatality of pesticide poisoning (10·5% for 2002–06 to 3·7% for 2013–19), largely attributable to pesticide bans. A modest fall in case fatality for non-banned pesticides was also seen.

Interpretation

Declines seen in case fatalities of poisonings with non-banned pesticides suggest that medical management improved over time. The human data for acute toxicity of pesticides should drive hazard classifications and regulation. We believe that a global benchmark for registration of pesticides should include a less than 5% case fatality after self-poisoning, which could prevent many deaths and have a substantial effect on global suicide rates.

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I. B. Gawarammana; South Asian Clinical Toxicology Research Collaboration, Faculty of Medicine, University of Peradeniya, Kandy

What is a species in fungal plant pathogens?

Fungal Diversity, Vol 109, pp 239–266

Ruvishika S. Jayawardena, Kevin D. Hyde, Antonio Roberto Gomes de Farias, Chitrabhanu S. Bhunjun, Himashi S. Ferdinandez, Dimuthu S. Manamgoda, Dhanushka Udayanga, Indunil S. Herath, Kasun M. Thambugala, Ishara S. Manawasinghe, Achala J. Gajanayake, Binu C. Samarakoon, Digvijayini Bundhun, Deecksha Gomdola, Naruemon Huanraluek, Ya-ru Sun, Xia Tang, Itthayakorn Promputtha, Marco Thines

Abstract

Scientific names are crucial for communicating knowledge concerning fungi and fungus-like organisms. In plant pathology, they link information regarding biology, host range, distribution and potential risk to agriculture and food security. In the past, delimitation among pathogenic taxa was primarily based on morphological characteristics. Due to distinct species sharing overlapping characteristics, the morphological identification of species is often neither straightforward nor reliable. Hence, the phylogenetic species concept based on molecular phylogenetic reconstructions gained importance. The present opinion discusses what a fungal species is and how identification of species in plant pathology has changed over the past decades. In this context, host-specialization and species complexes are discussed. Furthermore, species concepts in plant pathology are examined using case studies from *Bipolaris, Colletotrichum, Curvularia, Diaporthe, Diplodia, Meliola, Plasmopara*, rust fungi and *Trichoderma*. Each entry contains a brief introduction to the genus, concepts used in species identification so far and the problems in describing a species followed by recommendations. The importance of correctly naming and identifying a species is addressed in the context of recent introductions, and we also discuss whether the introduction of new species in pathogenic genera has been overestimated. We also provide guidelines to be considered when introducing a new species in a plant pathogenic genus.

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Climate-Change Pledges, Actions, and Outcomes

Journal of the European Economic Association, Vol 19, Iss 6, pp 2958–2991

Tiloka de Silva, Silvana Tenreyro

Abstract
We study countries' compliance with the targets pledged in international climate-change agreements and the impact of those agreements and specific climate laws and policies on greenhouse-gas emissions and economic outcomes. To do so, we compile and codify data on international agreements and measures enacted at the national and sub-national levels. We find that compliance with targets has been mixed. Still, countries that signed the Kyoto Protocol or the Copenhagen Accord experienced significant reductions in emissions when compared to non-signatories. Having quantifiable targets led to further reductions. Effects from the Paris Agreement are not yet evident in the data. Carbon taxes and the introduction of emission-trading schemes led to material reductions in emissions. Other climate laws or policies do not appear to have had, individually, a material effect on emissions. The impact on GDP growth or inflation from most measures was largely insignificant. Overall, much more ambitious targets would be needed to offset the impact of economic and population growth on emissions and contain the expansion of the stock of gases. (JEL: Q54, O44)

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Early reduction in PD-L1 expression predicts faster treatment response in human cutaneous leishmaniasis

The Journal of Clinical Investigation, Vol 131, Iss 22, Art No e142765

Nidhi S. Dey, Sujai Senaratne, Vijani Somaratne, Nayani P. Madarasinghe, Bimalka Seneviratne, Sarah Forrester, Marcela Montes de Oca, Luiza Campos Reis, Srija Moulik, Pegine B. Walrad, Mitali Chatterjee, Hiro Goto, Renu Wickremasinghe, Dimitris Lagos, Paul M. Kaye, Shalindra Ranasinghe

Abstract

Cutaneous leishmaniasis (CL) is caused by Leishmania donovani in Sri Lanka. Pentavalent antimonials (e.g., sodium stibogluconate [SSG]) remain first-line drugs for CL with no new effective treatments emerging. We studied whole blood and lesion transcriptomes from Sri Lankan patients with CL at presentation and during SSG treatment. From lesions but not whole blood, we identified differential expression of immune-related genes, including immune checkpoint molecules, after onset of treatment. Using spatial profiling and RNA-FISH, we confirmed reduced expression of programmed death-ligand 1 (PD-L1) and indoleamine 2,3-dioxygenase 1 (IDO1) proteins on treatment in lesions of a second validation cohort and further demonstrated significantly higher expression of these checkpoint molecules on parasite-infected compared with noninfected lesional CD68+ monocytes and macrophages. Crucially, early reduction in PD-L1 but not IDO1 expression was predictive of rate of clinical cure (HR = 4.88) and occurred in parallel with reduction in parasite load. Our data support a model whereby the initial anti–leishmanial activity of antimonial drugs alleviates checkpoint inhibition on T cells, facilitating immune-drug synergism and clinical cure. Our findings demonstrate that PD-L1 expression can be used as a predictor of rapidity of clinical response to SSG treatment in Sri Lanka and support further evaluation of PD-L1 as a host-directed therapeutic in leishmaniasis.

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Immune responses to a single dose of the AZD1222/Covishield vaccine in health care workers

Nature Communications, Vol 12, Art No.4617

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Abstract

Several COVID-19 vaccines have received emergency approval. Here we assess the immu-nogenicity of a single dose of the AZD1222 vaccine, at one month, in a cohort of health care workers (HCWs) (629 naïve and 26 previously infected). 93.4% of naïve HCWs ser-oconverted, irrespective of age and gender. Haemagglutination test for antibodies to the receptor binding domain (RBD), surrogate neutralization assay (sVNT) and ex vivo IFNγ ELISpot assays were carried out in a sub-cohort. ACE2 blocking antibodies (measured by sVNT) were detected in 67/69 (97.1%) of naïve HCWs. Antibody levels to the RBD of the wild-type virus were higher than to RBD of B.1.1.7, and titres to B.1.351 were very low. Ex vivo T cell responses were observed in 30.8% to 61.7% in naïve HCWs. Previously infected HCWs, developed significantly higher ($p < 0.0001$) ACE2 blocking antibodies and antibodies to the RBD for the variants B.1.1.7 and B.1.351. This study shows high seroconversion after one vaccine dose, but also suggests that one vaccine dose may be insufficient to protect against emerging variants.

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A plant virus satellite RNA directly accelerates wing formation in its insect vector for spread

Nature Communications, Vol 12, Art No. 7087

Wikum H. Jayasinghe, Hangil Kim, Yusuke Nakada, Chikara Masuta

Abstract

Cucumber mosaic virus (CMV) often accompanies a short RNA molecule called a satellite RNA (satRNA). When infected with CMV in the presence of Y-satellite RNA (Y-sat), tobacco leaves develop a green mosaic, then turn yellow. Y-sat has been identified in the fields in Japan. Here, we show that the yellow leaf colour preferentially attracts aphids, and that the aphids fed on yellow plants, which harbour Y-sat-derived small RNAs (sRNAs), turn red and subsequently develop wings. In addition, we found that leaf yellowing did not necessarily reduce photosynthesis, and that viral transmission was not greatly affected despite the low viral titer in the Y-sat-infected plants. Y-sat-infected plants can therefore support a sufficient number of aphids to allow for efficient virus transmission. Our results demonstrate that Y-sat directly alters aphid physiology via Y-sat sRNAs to promote wing formation, an unprecedented survival strategy that enables outward spread via the winged insect vector.

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Applicability of protocols from high-income countries in a resource limited setting; real world data of histopathology, clinical features and long-term outcome of Hodgkin Lymphoma in Sri Lanka

EClinicalMedicine, Vol 38, Art No.100998

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Ananda Wijewickrama, Gnani Somasundaram, Vadivelu Srinivasan, Surjit Somiah,
Priyankara Jayawardena, Rohini Wadanamby, Geethani Galagoda, Chathuri Jayasinghe,
Chandu De Silva, Sanjeewa Munasinghe, Bandula Wijesiriwardena, Jayantha Balawardena

Abstract

Background

There is a significant disparity in global cancer care and out-come between countries. We aimed to provide data on characteristics, average cost of treatment and survival estimates in patients with Hodgkin Lymphoma in Sri Lanka.

Methods: All patients diagnosed with Hodgkin Lymphoma between 01.05.2013 and 01.10.2020 were included in the analysis.

Findings

Classical Hodgkin Lymphoma(cHL) diagnosed in 85%; 68% presented with B symptoms and 61% had advanced stage of disease. Treatment was discontinued by 23% either before or just after starting treatment of whom 72% percent were females. The complete response (CR) rate of patients who continued treatment was 86% while the estimated five-year survival rate is 92%. Seventeen percent of these patients died but only two percent due to Hodgkin Lymphoma or associated treatment in the group which continued treatment compared to 45% in the group who defaulted treatment (p-value 0.0002). Five-year survival rate of patients who defaulted treatment was 50% while patients who continued treatment have an estimated five-year sur-vival rate of 90%. Average cost of first line treatment was between US$ 2280 and US$ 7642. First treatment failure may incur substantially higher health care costs.

Interpretation

This is the only well characterized study on long-term survival of patients with Hodgkin Lym-phoma in Sri Lanka. We have shown that it is possible to successfully apply western treatment and support-ive care protocols to the local population. This published data will help to bench mark and improve the treatment and develop blood cancer care in the local setting.

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S. Munasinghe; Military Hospital, Colombo
J. Balawardena; Sir John Kotelawala Defence University, Werahera, Colombo

Characterization of Event-Based Sampling Encoders for Industrial Internet of Things Using Input–Output Mutual Information

IEEE Transactions on Industrial Informatics, Vol 17, Iss 8, pp 5495 – 5505

Upeka Premaratne, Sujan Warnakulasooriya, Rasika Nandana

Abstract
The emergence of Industry 4.0 has resulted in a rapid increase in the demand for bandwidth due to the proliferation of the industrial Internet of Things (IIoT). Increased utilization of the network also gives rise to undesirable consequences such as high latency and increased likelihood of data loss through packet drops. Encoding inputs using event-based sampling is a potential solution for decreasing network traffic generated when continuous input variables are sampled. The problem addressed by this article is the fact that currently there is no effective method for comparing different encoders. The resulting contribution is the use of mutual information to compare the input and encoded output in terms of accuracy for the currently most efficient encoders that use either memory-based event triggering (MBET) or deadband error modulation (DEM). This allows a practitioner to select a suitable encoder for a given input specification.

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Increased Intensity of PCR Testing Reduced COVID-19 Transmission Within Countries During the First Pandemic Wave

Health Affairs, Vol 40, Iss 1, pp 70-81

Ravindra Prasan Rannan-Eliya, Nilmini Wijemunige, J. R. N. A. Gunawardana, Sarasi N. Amarasinghe, Ishwari Sivagnanam, Sachini Fonseka, Yasodhara Kapuge, Chathurani P. Sigera

Abstract

Experts agree that reverse transcription–polymerase chain reaction (PCR) testing is critical in controlling coronavirus disease 2019 (COVID-19), but decision makers disagree on how much testing is optimal. Controlling for interventions and ecological factors, we used linear regression to quantify testing's impact on COVID-19's average reproduction number, which represents transmissibility, in 173 countries and territories (which account for 99 percent of the world's COVID-19 cases) during March–June 2020. Among interventions, PCR testing had the greatest influence: a tenfold increase in the ratio of tests to new cases reported reduced the average reproduction number by 9 percent across a range of testing levels. Our results imply that mobility reductions (for example, shelter-in-place orders) were less effective in developing countries than in developed countries. Our results help explain how some nations achieved near-elimination of COVID-19 and the failure of lockdowns to slow COVID-19 in others. Our findings suggest that the testing benchmarks used by the World Health Organization and other entities are insufficient for COVID-19 control. Increased testing and isolation may represent the most effective, least costly alternative in terms of money, economic growth, and human life for controlling COVID-19.

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Power Control for Body Area Networks: Accurate Channel Prediction by Lightweight Deep Learning

IEEE Internet of Things Journal, Vol 8, Iss 5, pp 3567 - 3575

Yizhou Yang, David Smith, Jathushan Rajasegaran, Suranga Seneviratne

Abstract

Recent advances in the Internet of Things (IoT) are reforming the health care industry by providing higher communication efficiency, lower costs, and higher mobility. Among the many IoT applications, wireless body area networks (BANs) are a remarkable solution caring for a rapidly growing aged population. Predictive transmit power control schemes improve BAN communications' reliability and energy efficiency through long-term optimal radio resources allocation that supports consistent pervasive healthcare services. Here, we propose LSTM-based neural network (NN) prediction methods that provide long-term accurate channel gain prediction of up to 2 s over nonstationaryBAN on-body channels. An incremental learning scheme, which enables the LSTM predictor to operate online, is also developed for dynamic scenarios. Our main contribution is a lightweight NN predictor, "LiteLSTM," that has a compact structure and higher computational efficiency than other variants. We show that LiteLSTM remains functional under an incremental learning scheme, with only marginal performance degradation when implemented on hand-held devices. For optimal power allocation, we develop an interquartile range (IQR)-based power control for our channel prediction. When extensively tested using empirical channel measurements at different sampling rates, our proposed methods outperform the existing state-of-the-art methods in terms of prediction accuracy, power consumption, level crossing rate (LCR), and outage probability and duration.

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Evaluation of financial incentives for green buildings in Canadian landscape

Renewable and Sustainable Energy Reviews, Vol 135, Art No. 110199

Anber Rana, Rehan Sadiq, M. Shahria Alam, Hirushie Karunathilake, Kasun Hewage

Abstract
Financial Incentives (FIs) for green buildings are a major component of energy policy planning and play a vital role in the promotion of sustainable development and carbon mitigation strategies. Despite the presence of numerous FIs in Canada, there is still a lack of understanding on their distribution and effectiveness. This review first investigates the FIs available for residential and commercial buildings in Canada, and then performs a comprehensive review of studies related to FIs' effectiveness evaluation. It is found that FIs for buildings in Canada can be distributed into four categories: tax, loans, grants, and rebates. Among these, rebates from utility providers are the most common and are administered in all provinces. In addition to these, special incentives are available for three end-users (low-income, aboriginal people, landlords and tenants) and for three types of buildings (heritage, non-profit and energy rated). A clear contrast is observed on FIs offered in three regulatory regimes (Federal, provincial and municipal). Four provinces (Alberta, British Columbia, Ontario and Quebec) are leading in green building efforts. The in-depth literature review was also used to develop an understanding on the criteria used in effectiveness evaluation and the factors impacting effectiveness. Based on the findings of different studies on FIs effectiveness, a generic approach for evaluation of FIs is proposed that can help in deploying successful FIs programs. The results of this review are of importance to the policymakers, government authorities, and utilities engaged in designing and improving FIs for energy efficient buildings.

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Variable speed pumped hydro storage: A review of converters, controls and energy management strategies

Renewable and Sustainable Energy Reviews, Vol 135, Art No. 110156

Krishnakumar R. Vasudevan, Vigna K. Ramachandaramurthy, Gomathi Venugopal, B. Ekanayake, S.K. Tiong

Abstract

The increasing share of renewables in the power generation mix makes the power system volatile to uncertain meteorological conditions. The stochastic nature of renewables demands energy storage systems (ESS) to maintain the stability of the grid. Among various ESS, pumped hydro storage (PHS) is a technically matured and economically viable option for large scale energy storage. However, it has not gained much attention from re-searchers due to its technical maturity and site-specific nature. Lately, the focus is shifting towards the development of variable speed PHS and different reservoir schemes to realize PHS with the existing infrastructure. Nevertheless, the development of variable speed PHS necessitates a proper selection of power converter topology with a suitable control technique. Thus, the principal objective of this paper is to present a critical review of different levels of control of the variable speed PHS. Firstly, a state-of-the-art comparison between PHS and other ESS is presented through critical data analysis using Tableau software. Secondly, the control strategies are categorized into a hierarchical structure and reviewed based on a bottom-up approach. Towards the end, a synoptic review is presented to elucidate the dominating strategy at each level of the control hierarchy. Finally, the domains which require further attention are distinctively reported to leverage the future research of PHS.

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Nonclonal *Burkholderia pseudomallei* Population in Melioidosis Case Cluster, Sri Lanka

Emerging Infectious Diseases, Vol 27, Iss 11, pp 2955–2957

Himali S. Jayasinghearachchi, Vaithehi R. Francis, Harindra D. Sathkumara, Shivankari Krishnananthasivam, Jayanthi Masakorala, Thilini Muthugama, Aruna D. De Silva, Enoka M. Corea

Summary
A melioidosis case cluster of 10 blood culture–positive patients occurred in eastern Sri Lanka after an extreme weather event. Four infections were caused by *Burkholderia pseudomallei* isolates of sequence type 594. Wholegenome analysis showed that the isolates were genetically diverse and the case cluster was nonclonal.

H. S. Jayasinghearachchi, M. T. A. Muthugama, A. D. De Silva; General Sir John Kotelawala Defense University, Ratmalana
V. R. Francis; Eastern University, Vantharumoolai
S. M. H. D. Sathkumara, S. Krishnananthasivam; Genetech Research Institute, Colombo
J. Masakorala, E. M. Corea; University of Colombo, Colombo

Plague Transmission from Corpses and Carcasses

Emerging Infectious Diseases, Vol 27, Iss 8, pp 2033-2041

Sophie Jullien, Nipun Lakshitha de Silva, Paul Garner

Summary
Knowing whether human corpses can transmit plague will inform policies for handling the bodies of those who have died of the disease. We analyzed the literature to evaluate risk for transmission of *Yersinia pestis*, the causative agent of plague, from human corpses and animal carcasses. Because we could not find direct evidence of transmission, we described a transmission pathway and assessed the potential for transmission at each step. We examined 3 potential sources of infection: body fluids of living plague patients, infected corpses and carcasses, and body fluids of infected corpses. We concluded that pneumonic plague can be transmitted by intensive handling of the corpse or carcass, presumably through the inhalation of respiratory droplets, and that bubonic plague can be transmitted by blood-to-blood contact with the body fluids of a corpse or carcass. These findings should inform precautions taken by those handling the bodies of persons or animals that died of plague.

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Review on Oscillatory Stability in Power Grids with Renewable Energy Sources: Monitoring, Analysis, and Control Using Synchrophasor Technology

IEEE Transactions on Industrial Electronics, Vol 68, Iss 1, pp 519 – 531

Lasantha Gunaruwan Meegahapola, Siqi Bu, Darshana Prasad Wadduwage, Chi Yung Chung, Xinghuo Yu

Abstract
Oscillatory stability has received immense attention in recent years due to the significant increase in power electronic converter (PEC)-interfaced renewable energy sources. Synchrophasor technology offers superior capability to measure and monitor power systems in real time, and power system operators require better understanding of how it can be used to effectively analyze and control oscillations. This article reviews state-of-the-art oscillatory stability monitoring, analysis, and control techniques reported in the published literature based on synchrophasor technology. An updated classification is presented for power system oscillations with a special emphasis on oscillations induced from PEC-interfaced renewable energy generation. Oscillatory stability analysis techniques based on synchrophasor technology are well established in power system engineering, but further research is required to effectively utilize synchrophasor based oscillatory stability monitoring, analysis, and control techniques to characterize and mitigate PEC-induced oscillations. In particular, emerging big data analytics techniques could be used on synchrophasor data streams to develop oscillatory stability monitoring, analysis, and damping techniques.

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A Discrete-Time Markov Chain Based Comparison of the MAC Layer Performance of C-V2X Mode 4 and IEEE 802.11p

IEEE Transactions on Communications, Vol 69, Iss 4

Geeth P. Wijesiri N.B.A., Jussi Haapola , Member, Tharaka Samarasinghe

Abstract
Vehicle-to-vehicle (V2V) communication plays a pivotal role in intelligent transport systems (ITS) with cellular-vehicle to everything (C-V2X) and IEEE 802.11p being the two competing enabling technologies. This paper presents multi-dimensional discrete-time Markov chain (DTMC) based models to study the medium access control (MAC) layer performance of the IEEE 802.11p standard and C-V2X Mode 4, considering periodic cooperative awareness messages (CAMs) and event-driven decentralized environmental notification messages (DENMs). Closed-form solutions for the steady-state probabilities of the models are obtained, which are then utilized to derive expressions for several key performance metrics. Numerical results are provided to draw insights on the performance. In particular, a performance comparison between IEEE 802.11p and C-V2X Mode 4 in terms of the average delay, the collision probability, and the channel utilization is presented. The results show that IEEE 802.11p is superior in terms of average delay,
whereas C-V2X Mode 4 excels in collision resolution. The paper also includes design insights on possible future MAC layer performance enhancements of both standards.

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Community-level decentralized energy system planning under uncertainty: A comparison of mathematical models for strategy development

Applied Energy, Vol 283, Art No. 116304

Tharindu Prabatha, Hirushie Karunathilake, Amin Mohammadpour Shotorbani, Rehan Sadiq, Kasun Hewage

Abstract

Distributed energy systems renewable energy are one solution to the environmental and economic concerns of energy use. While energy planning and optimization have been conducted mainly as a mathematical exercise, practical approaches that incorporate the engineering realities and uncertainties are limited. Decision makers find challenges in community energy planning due to the lack of expertise, planning tools, and information. While a multitude of models and tools are currently available, there are no means of identifying the most appropriate or accurate methods, especially considering uncertainty. The main objective of this study is to compare and identify the strengths and limitations of various mathematical modelling techniques used in energy planning for grid connected renewable energy systems. As a case study demonstration, different multi-objective optimization techniques with and without uncertainty consideration (i.e. robust optimization, linear optimization, Taguchi Orthogonal Array method, and Monte Carlo simulation) were applied on a selected neighborhood in British Columbia. The optimization outcomes and the time and effort for evaluation were compared for the different methods. The findings indicate that robust optimization can be used to develop an uncertainty-based decision model. It significantly reduces evaluation time compared to the other methods. Although the presence of uncertainties can change the optimal configuration of a planned energy system, the assessment method itself does not significantly impact the outcomes. The findings of this study will enable the energy planners and researchers to compare different multi-objective optimization techniques, and to select the best for planning renewable energy projects, especially during the pre-project planning stage.

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Comparative analysis of two-step GA-based PV array reconfiguration technique and other reconfiguration techniques

Energy Conversion and Management, Vol 230, Art No. 113806

Aidha Muhammad Ajmal, Vigna K. Ramachandaramurthy, Amirreza Naderipour, Janaka B. Ekanayake

Abstract

Photovoltaic (PV) plants can be exposed to partial shading, which reduces the energy production and causes multi-peaks to form in the Power-Voltage (P-V) curve. As a result, the row currents of the PV modules will not be constant. Several techniques have been proposed to overcome partial shading, such as the static and dynamic reconfiguration techniques, with both aiming to reduce the difference in the row currents to improve energy production. Minimization of the row current via static techniques requires laborious work and extra wiring. On the other hand, dynamic techniques require an extensive monitoring system to support different tasks. Therefore, to improve the power generated from the PV array, this paper suggests a new reconfiguration technique for PV panels using Genetic algorithm (GA) and two main reconfigurable steps based on a switching matrix. In this technique, only the electrical connections of the PV panels are changed while its physical location remains unchanged. To verify the effectiveness of the proposed reconfiguration technique, the system was simulated and tested using MATLAB/SIMULINK software, with four shading patterns. The results were compared with other reconfiguration techniques, namely TCT configuration, competence square (CS), SuDoKu, two-phase array reconfiguration, Genetic algorithm (GA), Particle Swarm Optimization (PSO), and Modified Harris Hawks Optimization (MHHO). The performance of each shading case was also analyzed. Also, a comparative study on performance analysis in real-time application was carried out for each shading pattern. The results prove the superiority of the proposed technique over other techniques for overcoming partial shading.

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Performance Analysis of a Two-Tile Reconfigurable Intelligent Surface Assisted 2 × 2 MIMO System

IEEE Wireless Communications Letters, Vol 10, Iss 3, pp 493-497

Prathapasinghe Dharmawansa, Saman Atapattu, Marco Di Renzo

Abstract

We consider a two–tile reconfigurable intelligent surface (RIS) assisted wireless network with a two-antenna transmitter and receiver over Rayleigh fading. We show that the average received signal-to-noise-ratio (SNR) optimal combining and transmission vectors are given by the left and right singular spaces of the RIS-receiver and transmit-RIS channel matrices, respectively. Moreover, the optimal phases at the two tiles of the RIS are determined by the phases of the elements of the latter spaces. To further study the effect of phase compensation, we statistically characterize the average SNR of all possible combinations of transmission and combining directions pertaining to the latter singular spaces by deriving novel expressions for the outage probability and throughput of each of those modes. Furthermore, for comparison, we derive the corresponding expressions in the absence of RIS. Our results show an approximate SNR improvement of 2 dB due to the phase compensation at the RIS.

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Pay-As-You-Go: A Wireless Power Transfer-Enabled Beamforming for Cooperative Communication Systems

IEEE Wireless Communications Letters, Vol 10, Iss 1, pp 11-15

Selvakumar Tharranetharan, Dushantha Nalin K. Jayakody, P. Muthuchidambaranathan, Zheng Chang, Moises Ribeiro

Abstract
This letter considers a wireless power transfer enabled cooperative communication system where the end-users (EUs) make use of WPT to send energy to intermediate RUs to receive information. In traditional cooperative communications systems, service provider provides the energy for cooperation and the networks are optimized from the service providers' perspectives. In this system, EUs compensate for the energy requirements of RUs, and EUs should get a fair service back from RUs. To administrate EUs WPT and ensure the fair service policy, this proposes a novel beamforming technique named Pay-As-You-Go beamforming. This adapts data rates proportional to the amount of energy received from each EUs while optimizing the energy per bit cost of the overall system. Then formulated as an non convex optimization problem and solved with the semi-definite programming relaxation techniques.

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A Bayesian approach to model the trends and variability in urban stormwater quality associated with catchment and hydrologic parameters

Water Research, Vol 197, Art No. 117076

Thamali Perera, James McGree, Prasanna Egodawatta, K.B.S.N. Jinadasa, Ashantha Goonetille

Abstract
Stormwater runoff pollution has become a key environmental issue in urban areas. Reliable estimation of stormwater pollutant discharge is important for implementing robust water quality management strategies. Even though significant attempts have been undertaken to develop water quality models, deterministic approaches have proven inappropriate as they do not address the variability in stormwater quality. Due to the random nature of rainfall characteristics and the differences in catchment characteristics, it is difficult to generate the runoff pollutographs to a desired level of certainty. Bayesian hierarchical modelling is an effective tool for developing complex models with a large number of sources of variability. A Bayesian model does not look for a single value of the model parameters, but rather determines a distribution of the model parameters from which all inference is drawn. This study introduces a Bayesian hierarchical linear regression model to describe a catchment specific runoff pollutograph incorporating the associated uncertainties in the model parameters. The model incorporates catchment and rainfall characteristics including the effective impervious area, time of concentration, rain duration, average rainfall intensity and the antecedent dry period as the contributors to random effects.

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Weathering of microplastics and interaction with other coexisting constituents in terrestrial and aquatic environments

Water Research, Vol 196, Art No. 117011

Jiajun Duan, Nanthi Bolan, Yang Li, Shiyuan Ding, Thilakshani Atugoda, Meththika Vithanage, Binoy Sarkar, Daniel C.W. Tsang, M.B. Kirkham

Abstract

Weathering of microplastics (MPs, < 5 mm) in terrestrial and aquatic environments affects MP transport and distribution. This paper first summarizes the sources of MPs, including refuse in landfills, biowastes, plastic films, and wastewater discharge. Once MPs enter water and soil, they undergo different weathering processes. MPs can be converted into small molecules (e.g., oligomers and monomers), and may be completely mineralized under the action of free radicals or microorganisms. The rate and extent of weathering of MPs depend on their physicochemical properties and environmental conditions of the media to which they are exposed. In general, water dissipates heat better, and has a lower temperature, than land; thus, the weathering rate of MPs in the aquatic environment is slower than in the terrestrial environment. These weathering processes increase oxygen-containing functional groups and the specific surface area of MPs, which influence the sorption and aggregation that occur between weathered MPs and their co-existing constituents. More studies are needed to investigate the various weathering processes of diverse MPs under natural field conditions in soils, sediments, and aquatic environments, to understand the impact of weathered MPs in the environment.

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Customer heterogeneity and innovation-based competitive strategy: A review, synthesis, and research agenda

Journal of Product Innovation Management, Vol 38, Iss 3, pp 315-333

Amali Wijekoon, Sandeep Salunke, Gerard A. Athaide

Abstract

Managing customer heterogeneity (CH), that is, differences among customers (e.g., consumers, business firms) is an important, yet challenging consideration for firms seeking innovation- based competitive advantage. To facilitate better understanding of the opportunities and challenges that CH presents, we conducted a systematic review of the literature linking CH with innovation- based competitive advantage. Initially, we synthesize extant CH literature to propose a multidimensional conceptualization and definition of the CH construct comprising three dimensions: customer need heterogeneity, customer knowledge heterogeneity, and customer relationship heterogeneity. Customer need heterogeneity refers to the extent to which customers' needs/preferences for a product offering differ from each other, customer knowledge heterogeneity indicates the degree to which customers have different knowledge levels regarding how their needs can be satisfied, and customer relationship heterogeneity indicates the extent to which customers have different preferences toward engaging in relationships with the firm. Next, we present an integrative summary of the empirically tested as well as theoretically proposed links between each CH dimension and its antecedents/outcomes. Finally, we draw upon the paradox literature to identify specific tensions associated with each CH dimension and rely on the dynamic capabilities literature to suggest how these tensions can be effectively managed. Collectively, we contribute to the emerging resource- based perspective of CH by offering a propositional model of how CH can be managed for innovation- based competitive advantage.

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Interactions between microplastics, pharmaceuticals and personal care products: Implications for vector transport

Environment International, Vol 149, Art No. 106367

Thilakshani Atugoda, Meththika Vithanage, Hasintha Wijesekara, Nanthi Bolan, Ajit K. Sarmah, Michael S. Bank, Siming You, Yong Sik Ok

Abstract

Microplastics are well known for vector transport of hydrophobic organic contaminants, and there are growing concerns regarding their potential adverse effects on ecosystems and human health. However, recent studies focussing on hydrophilic compounds, such as pharmaceuticals and personal care products (PPCPs), have shown that the compounds ability to be adsorbed onto plastic surfaces. The extensive use of PPCPs has led to their ubiquitous presence in the environment resulting in their cooccurrence with microplastics. The partitioning between plastics and PPCPs and their fate through vector transport are determined by various physicochemical characteristics and environmental conditions of specific matrices. Although the sorption capacities of micro-plastics for different PPCP compounds have been investigated extensively, these findings have not yet been synthesized and analyzed critically. The specific objectives of this review were to synthesize and critically assess the various factors that affect the adsorption of hydrophilic compounds such as PPCPs on microplastic surfaces and their fate and transport in the environment. The review also focuses on environmental factors such as pH, salinity, and dissolved organics, and properties of polymers and PPCP compounds, and the relationships with sorption dynamics and mechanisms. Furthermore, the ecotoxicological effects of PPCP-sorbed microplastics on biota and human health are also discussed.

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Exploring the visitors' decision-making process for Airbnb and hotel accommodations using value-attitude-behavior and theory of planned behavior

International Journal of Hospitality Management, Vol 96, Art No. 102950

Kayhan Tajeddini, S. Mostafa Rasoolimanesh, Thilini Chathurika Gamage, Emma Martin

Abstract

Accommodation purchase decision is a complex field that makes predictions of revisit intentions hard to examine. Our work explores psychological factors motivating visitors' decision-making concerning accommodation purchases by integrating the theory of planned behavior and value-attitude-behavior model. Using a group of multiple informants in Swiss universities, we performed partial least squares structural equation modeling to assess the impacts of subjective norm, attitude and perception of quality on visitors' revisit intention and loyalty in Airbnb and hotel contexts. Although the influence of said factors on purchase decisions varies in the two contexts, results suggest that subjective norm has an indispensable role in prompting revisit intention towards Airbnb and hotel accommodations. This paper's findings advance our understanding of visitors' decision-making processes concerning traditional hotels and accommodation establishments operating in sharing economy platforms.

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Association between chorionicity and preterm birth in twin pregnancies: a systematic review involving 29 864 twin pregnancies

BJOG: An International Journal of Obstetrics and Gynaecology, Vol 128, Iss 5, pp 788-796

S. Marleen, C. Dias, R. Nandasena, R. MacGregor, J. Allotey, J. Aquilina, A. Khalil, S. Thangaratinam

Summary

Background

The perinatal mortality and morbidity among twins vary by chorionicity. Although it is considered that monochorionicity is associated with an increased risk of preterm birth in twin pregnancies, no systematic review exists evaluating this association.

Objectives

This systematic review was undertaken to assess the association between preterm birth and chorionicity in twin pregnancies.

Search strategy

We searched the electronic databases from January 1990 to July 2019 without language restrictions.

Selection criteria

All studies on twin pregnancies where chorionicity and preterm birth were evaluated were included.

Data collection and analysis

Findings are reported as odds ratios with 95% confidence intervals. The estimates are pooled using random-effects meta-analysis.

Main results

From 13 156 citations, we included 39 studies (29 864 pregnancies). Monochorionicity was significantly associated with increased risk of preterm birth at ≤28, ≤32, ≤34 and <37 weeks in women asymptomatic and symptomatic for preterm labour (odds ratio [OR] 2.14, 95% CI 1.52–3.02, I2 = 46%, OR 1.55, 95% CI 1.27–1.89 I2 = 68%, OR 1.47, 95% CI 1.27–1.69, I2 = 60%, OR 1.66, 95% CI 1.43–1.93, I2 = 65%, respectively). Among those asymptomatic for preterm labour, significantly increased odds of preterm birth were seen for monochorionicity at gestations ≤34 weeks (OR 1.85, 95% CI 1.42–2.40, I2 = 25%) and <37 weeks (OR 1.75, 95% CI 1.22–2.53, I2 = 61%). Sensitivity analysis showed significantly increased odds of spontaneous preterm birth at ≤34 and <37 weeks for monochorionicity (OR 1.25, 95% CI 1.01–1.55, I2 = 0% and OR 1.41, 95% CI 1.13–1.78, I2 = 0%).

Conclusions

Monochorionicity is significantly associated with preterm birth at all gestations.

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Comparison of two assays to detect IgG antibodies to the receptor binding domain of SARS–CoV–2 as a surrogate marker for assessing neutralizing antibodies in COVID-19 patients

International Journal of Infectious Diseases, Vol 109, pp 85-89

Achala Kamaladasa, Banuri Gunasekara, Chandima Jeewandara, Deshni Jayathilaka, Ananda Wijewickrama, Dinuka Guruge, Ruwan Wijayamuni, T.K. Tan, Graham S. Ogg, Alain Townsend, Gathsaurie Neelika Malavige

Abstract

Background

Neutralizing antibodies (NAbs) are important for protection against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) reinfection. In this study, two assays that are correlated with NAbs were compared: the haemagglutination test (HAT) and the surrogate virus neutralization test (sVNT).

Methods

The specificity of the HAT was compared with the sVNT, and the sensitivity and persistence of antibodies in patients with varying severity of illness was assessed in a cohort of 71 patients at 4–6 weeks and 13–16 weeks. The kinetics were assessed in the first, second, and third weeks in patients with varying severity of acute illness.

Results

The specificity of the HAT was > 99%, and sensitivity was similar to the sVNT. The levels of HAT were significantly and positively correlated with those of the sVNT (Spearman's r = 0.78, P < 0.0 0 01). Patients with moderate and severe illness had higher HAT titres when compared to those with mild illness. Six of seven patients with severe illness had a titre of > 1:640 during the second week of illness, whereas only five of 31 patients with a mild illness had a titre of > 1:160 in the second week of illness.

Conclusions

Since the HAT is a simple and very cheap assay to perform, it would be ideal to use as an indicator of NAbs in resource-poor settings.

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Dynamics of maternally transferred antibodies against measles, mumps, and rubella in infants in Sri Lanka

International Journal of Infectious Diseases, Vol 107, pp 129-134

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Abstract

Background

Determining the dynamics of maternally transferred antibodies against measles, mumps, and rubella infections in infants is important for making evidence-based policy decisions regarding the timing of vaccination.

Methods

The levels of serum immunoglobulin G (IgG) developed against measles, mumps, and rubella infections were assessed using commercial ELISA kits in mother–newborn pairs (n = 294) and 6–12-month-old infants (n = 280) recruited from Colombo District, Sri Lanka. Antibody levels of mothers and their newborns were assessed with respect to sex and parity. Antibody levels and the protection conferred were assessed in a sample of infants who completed 6–12 months of age in relation to their age and sex. Antibody levels were compared between different age and sex groups using the Mann–Whitney U-test, and correlations of antibody titers were performed using the Spearman correlation test.

Results

The prevalence rates of seropositivity for measles, mumps, and rubella were 91.5%, 89%, and 88%, respectively, in mothers, and 95%, 91.5%, and 93%, respectively, in their newborns. The newborns had mean IgG levels exceeding those of the mothers ($P < 0.001$). Mothers with natural infections had higher antibody levels compared to vaccinated mothers, which resulted in a higher level of maternal transfer. All of the infants who were 9–10 months of age or older were seronegative for measles, all of those who were 10–11 months of age or older were seronegative for rubella, and all of those who were 11–12 months old were seronegative for mumps.

Conclusions

The maternal transfer of antibodies to newborns is efficient and renders protection until the infants are 6–7 months old in the case of mumps and rubella and 7–8 months old in the case of measles. Hence infants remain vulnerable to infections before the first dose of the MMR vaccine.

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Development of in-house ELISAs as an alternative method for the serodiagnosis of leptospirosis

International Journal of Infectious Diseases, Vol 105, pp 135-140

Roshan Niloofa, Lilani Karunanayake, H. Janaka de Silva, Sunil Premawansa, Senaka Rajapakse, Shiroma Handunnetti

Abstract

Background

Leptospirosis is most often diagnosed clinically, and a laboratory test with high diagnostic accuracy is required.

Methods

IgM and IgG ELISAs using Leptospira antigens were established and evaluated in relation to the microscopic agglutination test (MAT). Antigen preparation consisted of saprophytic Leptospira biflexa to detect genus-specific antibodies (genus-specific ELISA) and a pool of the five most prevalent Leptospira interrogans serovars in Sri Lanka to detect serovar-specific antibodies (serovar-specific ELISA). IgM and IgG immune responses were studied in severe and mild leptospirosis patients (n = 100 in each group).

Results

The ELISAs showed high repeatability and reproducibility. The serovar-specific IgM-ELISA showed a sensitivity of 80.2% and specificity of 89%; the genus-specific IgM-ELISA showed a sensitivity of 83.3% and specificity of 91%. The serovar- and genus-specific IgG-ELISAs showed sensitivities of 73.3% and 81.7%, respectively, and specificities of 83.3% and 83.3%, respectively. The commercial IgM-ELISA showed a sensitivity of 79.2% and specificity of 93%. The commercial IgG-ELISA showed a sensitivity of 50% and specificity of 96.7%. IgM levels observed in mild and severe leptospirosis patients were significantly higher than in the healthy control group, with mean absorbance values of 0.770, 0.778, and 0.163, respectively. Severe leptospirosis patients had significantly higher mean anti-leptospiral IgG levels compared to both mild leptospirosis patients and healthy control group subjects (0.643, 0.358, and 0.116, respectively; ANOVA, $p < 0.001$). The presence of anti-leptospiral IgG above an optical density of 0.643 at 1:100 could predict a high risk of severe disease.

Conclusion

The serovar-specific in-house ELISA could be used for the laboratory diagnosis of leptospirosis in endemic settings. The high levels of anti-leptospiral IgG observed suggest its value as a predictor of disease severity.

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Multi-objective dynamic optimization of seeded suspension polymerization process

Chemical Engineering Journal, Vol 426, Art No. 130797

Chamanthi Denisha Jayaweera, Mahinsasa Narayana

Abstract

The temperature profile of the seeded suspension polymerization process was optimized to maximize molecular weight, shell thickness and monomer conversion ratio of core–shell polymer particles. Extreme learning machine radial basis function neural networks with R2 values greater than 0.93 were developed, to predict polymer properties at any point in time, using data generated by a computational fluid dynamics model. The optimal combination of input parameters for each neural network was selected from a pool of 44 variables, by using a weight-based method that uses a support vector regression model, and a global exhaustive search algorithm, consecutively. The neural networks developed were incorporated into a genetic algorithm that maximizes the molecular weight, monomer conversion ratio and shell thickness. The optimum temperature profile generated by the algorithm satisfactorily maximized all target polymer properties. This study also demonstrates that a support vector machine classifier could be reliably used for imposing nonlinear inequality constraints for solving dynamic optimization problems.

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A review on disease burden and epidemiology of childhood parainfluenza virus infections in Asian countries

Reviews in Medical Virology, Vol 31, Iss 2, Art No. e2164

Rukshan A. M. Rafeek, Maduja V. M. Divarathna, Faseeha Noordeen

Summary
Human parainfluenza viruses (HPIVs) are an important cause of acute respiratory tract infections (ARTIs) in children less than 5 years, second only to human respiratory syncytial viruses (HRSVs). Generally, patients infected with HPIVs are treated in outpatient clinics, yet also contribute to ARTI-associated hospitalization in children. Although HPIV infections are well studied in developed countries, these infections remain under-investigated and not considered in the routine laboratory diagnosis of childhood ARTI in many developing countries in Asia. We performed an extensive literature search on the prevalence, epidemiology, and burden of HPIV infections in children less than 5 years in Asia using PubMed and PubMed Central search engines. Based on the literature, the prevalence of HPIV infection in Asia ranges from 1% to 66%. According to many studies, HPIV-3 is the major virus circulating among children; however, several studies failed to detect HPIV-4 due to unavailability of diagnostic tools. In Asian countries, HPIV contributes a substantial disease burden in children. The data in this review should assist researchers and public health authorities to plan preventive measures, including accelerating research on vaccines and antiviral drugs.

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Anammox bacteria in treating ammonium rich wastewater: Recent perspective and appraisal

Bioresource Technology, Vol 334, Art No. 125240

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Abstract

The discovery of anammox process has provided eco-friendly and low-cost means of treating ammonia rich wastewater with remarkable efficiency. Furthermore, recent studies have shown that the possibility of operating the anammox process under low temperatures and high organic matter contents broadening the application of the anammox process. However, short doubling time and extensive levels of sensitivity towards nutrients and environmental alterations such as salinity and temperature are the limitations in practical applications of the anammox process. This review article provides the recent yet comprehensive viewpoint on anammox bacteria and the key perspectives in applying them as an efficient strategy for wastewater treatment.

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Wastewater-based microalgal biorefineries for the production of astaxanthin and co-products: Current status, challenges and future perspectives

Bioresource Technology, Vol 342, Art No. 126018

Gannoru Kankanamalage Sanuji Hasara Nishshanka, Vinoj Chamilka Liyanaarachchi, Malith Premaratne, P.H.V. Nimarshana, Thilini U. Ariyadasa, Michael Kornaros

Abstract

The freshwater microalgae *Haematococcus pluvialis* and *Chlorella zofingiensis* are attractive biorefinery feedstocks in view of their ability to simultaneously synthesize astaxanthin and other valuable metabolites. Nonetheless, there are concerns regarding the sustainability of such biorefineries due to the high freshwater footprint of microalgae cultivation. The integration of wastewater as an alternative growth media is a promising approach to reduce freshwater demand. Wastewater-based cultivation enables the recovery of essential nutrients required for microalgae growth and consequently results in phycoremediation of wastewater, thus promoting the concept of a circular economy and further enhancing the sustainability of the process. In this review, recent developments in wastewater-integrated cultivation of *H. pluvialis* and *C. zofingiensis* for astaxanthin production are discussed. Furthermore, prospective strategies for overcoming the inherent challenges of wastewater-based cultivation are reviewed. Moreover, the biorefinery potential of wastewater-grown *H. pluvialis* and *C. zofingiensis* is delineated and future perspectives of wastewater-based biorefineries are outlined.

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Yeast assisted algal flocculation for enhancing nutraceutical potential of *Chlorella pyrenoidosa*

Bioresource Technology, Vol 340, Art No. 125670

Megha Mathur, Ankur Kumar, Thilini U. Ariyadasa, Anushree Malik

Abstract

The present research describes yeast assisted algal flocculation followed by evaluation of algae-yeast flocs for nutritional profile as potent food product. Co-flocculation of *Chlorella pyrenoidosa* using *Saccharomyces cerevisiae* showed 58.33 ± 2.37% flocculation efficiency. Nutrient composition of algae-yeast flocs (CP-Y) depicted higher protein content (35.52%) as compared to algae (23.72%) and yeast biomass (33.89). Amino acid profiles of CP-Y biomass depicted increase in essential amino acid content with higher ratio of essential to non-essential amino acid (0.68) as compared to Y (0.57) and CP (0.57) biomass. Lipid and carbohydrate content of CP-Y flocs was estimated as 26.95 ± 0.57% and 21.12 ± 0.83%, respectively. Fatty Acid Methyl Esters (FAME) analysis showed presence of omega rich polyunsaturated fatty acids (PUFAs) like α-linolenic acid (ω-3), Linoleic acid (ω-6), Palmitoleic acid (ω-7) etc in CP-Y biomass. The study provides novel insights on nutrition enriched biomass obtained after algal-yeast flocculation, which can be a better alternative to existing flocculation methods for food applications.

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The Host Response to Viral Infections Reveals Common and Virus-Specific Signatures in the Peripheral Blood

Frontiers in Immunology, Vol 12, Art No. 741837

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Summary

Viruses cause a wide spectrum of clinical disease, the majority being acute respiratory infections (ARI). In most cases, ARI symptoms are similar for different viruses although severity can be variable. The objective of this study was to understand the shared and unique elements of the host transcriptional response to different viral pathogens. We identified 162 subjects in the US and Sri Lanka with infections due to influenza, enterovirus/rhinovirus, human metapneumovirus, dengue virus, cytomegalovirus, Epstein Barr Virus, or adenovirus. Our dataset allowed us to identify common pathways at the molecular level as well as virus-specific differences in the host immune response. Conserved elements of the host response to these viral infections highlighted the importance of interferon pathway activation. However, the magnitude of the responses varied between pathogens. We also identified virus-specific responses to influenza, enterovirus/rhinovirus, and dengue infections. Influenza-specific differentially expressed genes (DEG) revealed up-regulation of pathways related to viral defense and down-regulation of pathways related to T cell and neutrophil responses. Functional analysis of entero/rhinovirus-specific DEGs revealed up-regulation of pathways for neutrophil activation, negative regulation of immune response, and p38MAPK cascade and down-regulation of virus defenses and complement activation. Functional analysis of dengue-specific up-regulated DEGs showed enrichment of pathways for DNA replication and cell division whereas down-regulated DEGs were mainly associated with erythrocyte and myeloid cell homeostasis, reactive oxygen and peroxide metabolic processes. In conclusion, our study will contribute to a better understanding of molecular mechanisms to viral infections in humans and the identification of biomarkers to distinguish different types of viral infections.

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Grappling with COVID-19 by imposing and lifting non-pharmaceutical interventions in Sri Lanka: A modeling perspective

Infectious Disease Modelling, Vol 6, pp 820-831

Mahesh Jayaweera, Chamath Dannangoda, Dilum Dilshan, Janith Dissanayake, Hasini Perera, Jagath Manatunge, Buddhika Gunawardana

Abstract
The imposition and lifting of non-pharmaceutical interventions (NPIs) to avert the COVID-19 pandemic have gained popularity worldwide and will continue to be enforced until herd immunity is achieved. We developed a linear regression model to ascertain the nexus between the time-varying reproduction number averaged over a time window of six days (Rts) and seven NPIs: contact tracing, quarantine efforts, social distancing and health checks, hand hygiene, wearing of facemasks, lockdown and isolation, and health-related supports. Our analysis suggests that the second wave that emerged in Sri Lanka in early October 2020 continued despite numerous NPIs.

The model indicates that the most effective single NPI was lockdown and isolation. Conversely, the least effective individual NPIs were hand hygiene and wearing of facemasks. The model also demonstrates that to mitigate the second wave to a satisfactory level (Rts<1), the best single NPI was the contact tracing with stringent imposition (% of improvement of Rts was 69.43 against the base case). By contrast, the best combination of two NPIs was the lockdown & isolation with health-related supports (% of improvement was 31.92 against the base case). As such, many health authorities worldwide can use this model to successfully strategize the imposition and lifting of NPIs for averting the COVID-19 pandemic.

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Organizational justice in the hotel industry: revisiting GLOBE from a national culture perspective

International Journal of Contemporary Hospitality Management, Vol 33, Iss 12, pp 4418-4438

Alireza Nazarian, Rezvan Velayati, Pantea Foroudi, Dilini Edirisinghe, Peter Atkinson

Abstract

Purpose

Despite its significance, national culture is often underrepresented in the hospitality industry. Implementing tools such as the global leadership and organizational behaviour effectiveness (GLOBE), whilst valuable to a considerable extent, might induce false assumptions about the universality of managerial practices for hotels through purposefully ignoring the in-group variations within each cultural cluster. Because employees' perceptions are deeply rooted in context-specific value systems, this study aims to challenge the tendency to adopt a globalized approach to leadership and management through investigating potential variations in employees' perceptions in two countries in the south Asian cluster of the GLOBE.

Design/methodology/approach

Data were collected by using hard-copy and online convenience-sampling techniques from a sample of hotel employees and managers in Iran (392) and India (421). Structural equation modelling using AMOS 22 was adopted to test the hypotheses.

Findings

Both similarities and differences were observed between the Iranian and Indian contexts. The similarities confirm that GLOBE is correct to place them in the same regional cluster but the differences which relate to perceptions of organizational justice are also revealing. Whilst procedural justice affects organizational factors that influence employee motivation with the Iranian sample, distributive justice has no effect, whereas with the Indian sample these results were the other way around.

Practical implications

For scholars and practitioners, the authors show that organizational theories and concepts cannot necessarily be transferred from a Western context to other parts of the world without making adjustments for national culture and generalizations cannot even be made within regions of similar culture. For example, this study shows that in Iran organizational justice is perceived differently from how it is perceived in India

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Prevalence and trends of the diabetes epidemic in urban and rural India: A pooled systematic review and meta-analysis of 1.7 million Adults

Annals of Epidemiology, Vol 58, pp 128-148

Priyanga Ranasinghe, Ranil Jayawardena, Nishadi Gamage, Nilani Sivanandam, Anoop Misra

Abstract

Purpose

India has experienced a recent sharp increase in diabetes/pre-diabetes. We conducted a systematic-review and meta-analyses to describe the most recent prevalence and trends of pre-diabetes/diabetes in urban and rural India.

Methods

Methods A literature search was conducted in PubMed and Scopus databases for population- based studies describing prevalence of diabetes/pre-diabetes in urban/rural populations. Trends were analysed in rural and urban settings overall, genderwise and statewise.

Results

The study reports data from 1,778,706 adults in India (69-studies), from surveys conducted from 1972-2017. Prevalence of diabetes increased in both rural and urban India from 2.4% and 3.3% in 1972 to 15.0% and 19.0% respectively in year 2015-2019. This was independently observed in both genders. Similar increasing prevalence was observed for pre-diabetes, overall and in both genders. In the latest decade (2010-2019) rural and urban prevalence was highest in states of Goa (17.4%) and Tamil Nadu (24.0%) respectively. Statewise analysis observed a wide disparity in prevalence between the North and the South of India.

Conclusion

Pooled estimates show a relatively high burden of diabetes and pre-diabetes in rural and urban India, with narrowed urban-rural gap. Hence, it is important to plan urgent primary and secondary prevention strategies to minimize further increase in areas with high prevalence.

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Effects of a lifestyle intervention programme after 1 year of follow- up among South Asians at high risk of type 2 diabetes: a cluster randomised controlled trial

BMJ Global Health, Vol 6, Art No. e006479

Mirthe Muilwijk, Marie Loh, Samreen Siddiqui, Sara Mahmood, Saranya Palaniswamy, Khurram Shahzad, Lathika K Athauda, Ranil Jayawardena, Tayyaba Batool, Saira Burney, Matthew Glover, Vodathi Bamunuarachchi, Manju Panda, Madawa Madawanarachchi, Baldeesh Rai, Iqra Sattar, Wnurinham Silva, Swati Waghdhare, Marjo- Riitta Jarvelin, Ravindra Prasan Rannan- Eliya, Nilmini Wijemunige, Heather M Gage, Jonathan Valabhji, Gary S Frost, Rajitha Wickremasinghe, Anuradhani Kasturiratne, Khadija I Khawaja, Sajjad Ahmad, Irene GM van Valkengoed, Prasad Katulanda, Sujeet Jha, Jaspal S Kooner, John C Chambers

Abstract

Introduction

South Asians are at high risk of type 2 diabetes (T2D). We assessed whether intensive family- based lifestyle intervention leads to significant weight loss, improved glycaemia and blood pressure in adults at elevated risk for T2D.

Methods

This cluster randomised controlled trial (iHealth- T2D) was conducted at 120 locations across India, Pakistan, Sri Lanka and the UK. We included 3684 South Asian men and women, aged 40–70 years, without T2D but with raised haemoglobin A1c (HbA1c) and/or waist circumference. Participants were randomly allocated either to the family- based lifestyle intervention or control group by location clusters. Participants in the intervention received 9 visits and 13 telephone contacts by community health workers over 1- year period, and the control group received usual care. Reductions in weight (aim >7% reduction), waist circumference (aim ≥5 cm reduction), blood pressure and HbA1C at 12 months of follow- up were assessed. Our linear mixed- effects regression analysis was based on intention- to- treat principle and adjusted for age, sex and baseline values.

Results

There were 1846 participants in the control and 1838 in the intervention group. Between baseline and 12 months, mean weight of participants in the intervention group reduced by 1.8 kg compared with 0.4 kg in the control group (adjusted mean difference −1.10 kg (95% CI −1.70 to −1.06), p<0.001). The adjusted mean difference for waist circumference was −1.9 cm (95% CI −2.5; to 1.3), p<0.001). No overall difference was observed for blood pressure or HbA1c. People who attended multiple intervention sessions had a dose-dependent effect on waist circumference, blood pressure and HbA1c, but not on weight.

Conclusion

An intensive family-based lifestyle intervention adopting low-resource strategies led to effective reduction in weight and waist circumference at 12 months, which has potential long-term benefits

for preventing T2D. A higher number of attended sessions increased the effect on waist circumference, blood pressure and HbA1c.

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Tikiri—Towards a lightweight blockchain for IoT

Future Generation Computer Systems, Vol 119, pp 154-165

Eranga Bandara, Deepak Tosh, Peter Foytik, Sachin Shetty, Nalin Ranasinghe, Kasun De Zoysa

Abstract
Internet of Things (IoT) platforms have been deployed in several domains to enhance efficiency of business process and improve productivity. Most IoT platforms comprise of heterogeneous software and hardware components which can potentially introduce security and privacy challenges. Blockchain technology has been proposed as one of the solutions to realize IoT security by leveraging the (a) Immutable ledger, (b) Decentralized architecture and (c) Strong cryptography primitives. However, integrating blockchain platforms with IoT based applications presents several challenges due to lack of (a) acceptable performance on resource-constrained devices, (b) high transaction throughput, (c) keyword-based search and retrieve, (d) transaction back pressure operations, and (e) real-time response. In this paper, we propose a lightweight blockchain platform, ''Tikiri'', for resource-constrained IoT devices. Tikiri uses Apache Kafka for the consensus and proposes new blockchain architecture to handle real-time transaction execution on the blockchain. Tikiri is characterized by functional programming and actor-based smart contract platform that realizes concurrent execution of transactions in the blockchain. Tikiri realizes a lightweight and scalable blockchain that can provides performance on the resource-constrained IoT devices.

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Hybrid phase equilibria modelling with conventional and trace element thermobarometry to assess the *P–T* evolution of UHT granulites: An example from the Highland Complex, Sri Lanka

Journal of Metamorphic Geology, Vol 39, Iss 2, pp 209-246

Prasanna L. Dharmapriya, Sanjeewa P. K. Malaviarachchi, Andrea Galli, Leo M. Kriegsman, Yasuhito Osanai, K. Sajeev, Ben-Xun Su, Toshiaki Tsunogae, Chengli Zhang, Tatsuro Adachi, Chandrasekara, B. Dissanayake, Nalaka Deepal Subasinghe

Abstract

Here we attempt to constrain the *P–T* evolution of ultrahigh-temperature granulites using textures coupled with multiple thermobarometric approaches. Sapphirine-bearing granulites were collected from a quarry in the central part of the Highland Complex of Sri Lanka. Three sapphirine-bearing domains were selected and petrographically studied. Homogeneous sample domains were thermodynamically modelled using their bulk compositions (forward phase equilibria modelling). One heterogeneous sample from a single domain, composed of irregularly distributed residuum and melt, was also used. The bulk composition of its residual part was calculated using mineral compositions and their respective modes. Equilibrium *T–X*(Fe2O3) phase diagrams were constructed in the chemical system NCKFMASHTO to estimate the bulk ferric/ferrous iron ratio, and conventional geothermometers (garnet–orthopyroxene and Al in orthopyroxene) were applied. The Ti in zircon trace element thermometer was also applied to calculate peak metamorphic conditions. Modal abundance isopleths of each mineral in equilibrium phase diagrams and textural observations were combined to constrain the retrograde *P–T* path. Our hybrid approach of forward and inverse phase equilibria modelling and conventional thermo-barometric calculations indicate that the sapphirine-bearing granulites have reached their peak T of 920–940°C at P ~10 kbar under relatively highly oxidizing conditions. Subsequently, the rocks followed a near-isobaric cooling path down to 890–860°C, prior to near-isothermal decompression up to 6 kbar. The results highlight the importance of dealing with Fe^{3+}. Multiple thermobarometric approaches on carefully observed mineral textures are required to retrieve the most reliable *P–T* conditions of HT/UHT mineral assemblages.

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Pharmaceutical and Personal Care Products (PPCPs) in the environment: Plant uptake, translocation, bioaccumulation, and human health risks

Critical Reviews in Environmental Science and Technology, Vol 51, Iss 12, pp 1221-1258

S. Keerthanan, Chamila Jayasinghe, Jayanta Kumar Biswas & Meththika Vithanage

Abstract

Pharmaceutical and personal care products (PPCPs) are considered as emerging contaminants (ECs) in the environment due to their known or suspected adverse ecological effects and human health risks. Wastewater, compost, and manure application release PPCPs into the agricultural soil systems. Since the plants can take up such ECs, they are considered as a primary window of human exposure to the PPCPs via the route of consumption of contaminated plants. This may lead to deleterious human health effects. However, as PPCPs are of various kinds, differential uptake and bioaccumulation in the plant have recently received research interest. Therefore, the present article reviewed the occurrence of PPCPs as antibiotics, anti-inflammatory drugs, hormones, cytostatic drugs, contrast media, b-blockers, blood lipid regulators, antiepileptic drugs, antimicrobials, ultra-violet filters, preservatives, insect repellents, and synthetic musks in the environment by assembling the literature. Moreover, plant uptake and translocation under the realistic and greenhouse condition, and the factors influencing the uptake and translocation through the plants are explicitly demonstrated in this review. Also, the human risk connected with the consumption of the contaminated plants and the research gap areas were investigated with future perspectives.

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Mining and classifying customer reviews: a survey

Artificial Intelligence Review, Vol 54, pp 6343–6389

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Abstract
With the increasing number of customer reviews on the Web, there is a growing need for effective methods to retrieve valuable information hidden in these reviews, as sellers need to gain a deep understanding of customers' preferences in a timely manner. With the continuous enhancement of opinion mining or sentiment analysis research, researchers have proposed many automatic mining and classification methods. However, how to choose a trusted method is a difficult problem for companies, because customer reviews (or opinions) contain a lot of uncertain information and noise. This article reports on a detailed survey of recent opinion mining literature. It also reviews how to extract text features in opinions that may contain noise or uncertainties, how to express knowledge in opinions, and how to classify them. Through this extensive study, this paper discusses open questions and recommends future research directions for building the next generation of opinion mining systems.

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The role of soils in the disposition, sequestration and decontamination of environmental contaminants

Philosophical Transactions of the Royal Society B: Biological Sciences, Vol 376, Iss 1834, Art No. 20200177

Binoy Sarkar, Raj Mukhopadhyay, Sammani Ramanayaka, Nanthi Bolan, Yong Sik Ok

Abstract
Soil serves as both a 'source' and 'sink' for contaminants. As a source, contaminants are derived from both 'geogenic' and 'anthropogenic' origins. Typically, while some of the inorganic contaminants including potentially toxic elements are derived from geogenic origin (e.g. arsenic and selenium) through weathering of parent materials, the majority of organic (e.g. pesticides and microplastics) as well as inorganic (e.g. lead, cadmium) contaminants are derived from anthropogenic origin. As a sink, soil plays a critical role in the transformation of these contaminants and their subsequent transfer to environmental compartments, including groundwater (e.g. pesticides), surface water (phosphate and nitrate), ocean (e.g. microplastics) and atmosphere (e.g. nitrous oxide emission). A complex transformation process of contaminants in soil involving adsorption, precipitation, redox reactions and biodegradation control the mobility, bioavailability and environmental toxicity of these contaminants. Soil also plays a major role in the decontamination of contaminants, and the 'cleaning' action of soil is controlled primarily by the physico-chemical interactions of contaminants with various soil components, and the biochemical transformations facilitated by soil microorganisms. In this article, we examine the geogenic and anthropogenic sources of contaminants reaching the soil, and discuss the role of soil in the sequestration and decontamination of contaminants in relation to various physico-chemical and microbial transformation reactions of contaminants with various soil components. Finally, we propose future actions that would help to maintain the role of soils in protecting the environment from contaminants and delivering sustainable development goals.

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Modelling of integrated local energy systems: Low-carbon energy supply strategies for the Oxford-Cambridge arc region

Energy Policy, Vol 157, Art No. 112474

Modassar Chaudry, Lahiru Jayasuriya, Nick Jenkins

Abstract
The energy supply system is undergoing enormous change to deliver against cost, security of supply and decarbonization objectives. Robust decisions on the provision of infrastructure requires integrated models to perform analytics across the entire energy supply chain. A national level combined gas and electricity transmission network model was upgraded to represent local energy systems. Multiple energy vectors including electricity, gas, hydrogen and heat were integrated within the modelling framework. The model was utilized for a study of the Oxford-Cambridge arc region. The study assessed how different energy supply strategies, from electrification of heat to use of 'green' gases or local heat networks, could affordably reduce carbon emissions from the Oxford-Cambridge arc region energy system whilst considering constraints from the national system. The modelling process generated a diverse range of options for energy supplies, the choice of supply networks and end use technologies. The analysis illustrated the cost effectiveness and emission reduction potential of electrification of heat despite the requirement for additional network and supply capacity. Additionally, insulation and other energy efficiency solutions were also analyzed. Potential barriers to technological change such as upfront costs, lack of awareness and perceived technology shortcomings were discussed in the context of the strategies assessed.

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Evaluation of the impact of runway characteristics on veer-off risk at rapid exit taxiways

Transportation Research Interdisciplinary Perspectives, Vol 12, Art No. 100480

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Abstract
Runway rapid exits are used as a method of reducing runway occupancy times of landing aircraft and thereby increasing its operational capacity. This is an important design improvement in the runway system of an airport that requires capacity improvement to meet the increasing demand. Due to the increased utilization of rapid exit taxiways, the number of accidents that could take place at rapid exits in the future could increase. The paper proposes a methodology to evaluate veer-off risks under different operational and design conditions at runway rapid exits. The method of analysis includes estimating veer-off probability along with the associated consequence. One of the key findings of this study is that a 30% increase in taxiway width and taxiway design radius result in 32% and 69 % reductions in veer-off risk respectively. The study provides a useful framework to incorporate veer-off risk when planning and design of rapid exit taxiways.

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Crustal Derivation of the ca. 475 Ma Eppawala Carbonatites in Sri Lanka

Journal of Petrology, Vol 62, Iss 11, Art No. egab075

Jing Wang, Ben-Xun Su, Chen Chen, Silvio Ferrero, Sanjeewa P. K. Malaviarachchi, Patrick Asamoah Sakyi, Yue-Heng Yang, P. L. Dharmapriya

Abstract

Although a mantle origin of carbonatites has long been advocated, a few carbonatite bodies with crustal fingerprints have been identified. The Eppawala carbonatites in Sri Lanka are more similar to orogenic carbonatites than those formed in stable cratons and within plate rifts. They occur within the Pan-African orogenic belt and have a formation age of ca. 475 Ma newly obtained in this study with no contemporary mantle-related magmatism. These carbonatites have higher ($^{87}Sr/^{86}Sr$)i ratios (0·70479–0·70524) and more enriched Nd and Hf isotopic compositions than carbonatites reported in other parts of the world. Model ages (1·3–2·0 Ga) of both Nd and Hf isotopes [apatite $\varepsilon_{Nd}(t)$ =−9·2to−4·7; rutile $\varepsilon_{Hf}(t)$ =−22·0to−8·02] are in the age range of metamorphic basement in Sri Lanka, and the carbon and oxygen isotopic compositions ($\delta_{13}C_{PDB}$ =−2·36 to −1·71‰; $\delta_{18}O_{SMOW}$ = 13·91–15·13‰) lie between those of mantle-derived carbonatites and marble. These crustal signatures are compatible with the chemistry of accessory minerals in the carbonatites, such as Ni-free olivine and Al- and Cr-poor rutile. Modeling results demonstrate that the Eppawala carbonatite magmas originated from a mixture of basement gneisses and marbles, probably during regional metamorphism. This interpretation is supported by the occurrence of the carbonatites along, or near, the axes of synforms and antiforms where granitic gneiss and marble are exposed. Therefore, we propose that the Eppawala carbonatites constitute another rare example of a carbonatitic magma that was derived from melting of a sedimentary carbonate protolith. Our findings suggest that other orogenic carbonatites with similar features should be re-examined to re-evaluate their origin.

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Land use and elevation interact to shape bird functional and phylogenetic diversity and structure: Implications for designing optimal agriculture landscapes

Journal of Applied Ecology, Vol 58, Iss 8, pp 1738-1748

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Abstract

1. The conversion of rainforests into agriculture resulted in massive changes in species diversity and community structure. Although the conservation of the remaining rainforests is of utmost importance, identifying and creating a biodiversity-friendly agriculture landscape is vital for preserving biodiversity and their functions.
2. Biodiversity studies in agriculture have often been conducted at low elevations. In this study, we compared the functional diversity (FD), phylogenetic diversity (PD) and community structure of birds along an interacting gradient of land use (protected rainforest, reserve buffer and agriculture) and elevation (low, middle and high) in Sri Lanka. Then, we measured the compositional change by identifying how ecological traits (dietary guild, vertical strata, body mass and dispersal ability) and conservation characteristics (forest dependence and threatened status) responded to land use types.
3. Elevation and land use interacted with each other to shape bird FD. Depending on the elevation, FD in agriculture was either higher or similar to forest. However, PD was similar across all elevation and land use types. Bird community structure in forest was functionally and phylogenetically clustered in comparison to agriculture. Insectivorous birds declined from forest to agriculture, and so did understorey and middle- storey birds. But frugivorous and canopy birds did not change across land use types, while nectarivores, granivores and carnivores proliferated in agriculture. Forests were dominated by birds with low dispersal abilities, but birds in agriculture had more evenly distributed dispersal abilities. About half of all the individuals in agriculture were composed of forest species, several of which were threatened.
4. Synthesis and applications. Most farmers in Sri Lanka practice agriculture on small farms (c. 2 ha) and rely on services (e.g. pest control and pollination) provided by biodiversity for their livelihoods. Our results underline the important role of these heterogeneous agriculture landscapes in maintaining high functional diversity (FD) and harbouring several threatened species. While FD in agriculture was comparatively high, conservation decisions based on land use alone cannot be reliable, because land use effects were elevation dependent. Thus, priority setting exercises aimed at designing optimal agriculture landscapes should consider landscape features, in combination with elevation, to benefit both people and wildlife outside protected areas.

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Exploring choice and expenditure on energy for domestic works by the Sri Lankan households: Implications for policy

Energy, Vol 222, Art No. 119899

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Abstract
The majority of households in developing countries rely on harmful energy sources for cooking and lighting due to socioeconomic constraints. This paper aims to examine patterns and determinants of household energy consumption choices using data collected from more than 55,000 Sri Lankan house-holds under three rounds of Household Income and Expenditure Surveys (HIES-1990/91, 2002, 2012/13). This study uses a multivariate probit model to estimate the drivers of fuel choices and a Seemingly Unrelated Regression (SUR) model estimation procedure to investigate household dependency on energy consumption. The results show that economically affluent households headed by relatively more educated heads are more likely to choose and spend more on clean energy, such as electricity and liquefied petroleum gas (LPG). The findings of the study support the energy ladder hypothesis, which states that with an increase in income and awareness, households gradually switch from dirty energy, such as biomass, firewood, and kerosene, to clean energy. Based on these findings, this study suggests that energy, environment, and health policy in developing countries should focus on increasing the awareness of the consequences of using dirty fuel and making clean energy affordable to ensure access to less harmful, clean, and green energy at affordable prices.

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Mobile energy hub planning for complex urban networks: A robust optimization approach

Energy, Vol 235, Art No. 121424

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Abstract
The electricity grid with a high penetration of renewable energy can enable travelers to travel free of emissions using state-of-the-art electric vehicles (EVs). Extensive electric vehicle demands at the peak-times, and an increase in electricity consumption due to population growth, have led to higher utility infrastructure investments. Mobile energy hubs i.e. clustered EVs parked in a dedicated location, can be used as an innovative demand-side management solution to reduce long-term utility infrastructure investments. They can store and release electricity to the grid based on consumer demand. However, a scientific planning approach for grid integration has been overlooked. Accordingly, this study proposes a comprehensive framework required to plan and develop mobile energy hubs based on optimization of life cycle cost, access distance and parking duration considering the temporal variation of EV recharging demands. The results of the study show that the framework developed can minimize lifecycle costs, and improve infrastructure utilization by accounting for the interests of all stakeholders. The total cost with the proposed robust optimization model under uncertainties of 50% is lesser than the robust cost calculated from a scenario-based approach. Furthermore, the developed framework is useful for recharging infrastructure planners to devise the deployment schedules and attract investors based on the economic viability of the planned strategies.

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Evaluating carbon capturing strategies for emissions reduction in community energy systems: A life cycle thinking approach

Energy, Vol 232, Art No. 121012

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Abstract
On-site carbon capturing, storage, and utilization (CCSU) has proven its' potential to reduce CO2 emissions from large-scale fossil fuel combustion systems. However, the integration of CCSU in community-scale on-site energy generation applications such as district energy systems has not been comprehensively explored in literature. This study aims to propose a life cycle thinking-based framework to compare and prioritize emission reduction strategies that include CCSU and renewable energy technologies to develop zero-emission community energy systems. The framework incorporates multi-criteria decision-making approaches to rank and prioritize community energy emission mitigation strategies. A scenario-based method was employed in assessing the performance of CCSU technologies along with other compatible alternative energy choices. The framework was demonstrated for all the provinces in Canada. Results show that CCSU is more favorable for regions with high dependence on fossil fuel-based energy sources. CCSU could reach the commercial scale if the cost of emission avoided drops below the cost of CO2 emissions. The findings of this study are geared towards providing practical decision-support tools for stakeholders who hold responsible for policy and investment decisions in community energy. The developed framework is a generalized technique that provides the flexibility to be employed in any location across the globe.

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Water sources and kidney function: investigating chronic kidney disease of unknown etiology in a prospective study

npj Clean Water, Vol 4, Art No.50

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Abstract
A chronic Kidney Disease of unknown etiology (CKDu) has emerged with disproportionately high prevalence across dry lowland agricultural communities globally. Here we present the results of a prospective cohort of 293 patients with CKDu in the endemic region of Wilgamuwa, Sri Lanka, in whom we measured baseline kidney function and undertook quarterly follow up over 2 years. Well water was the primary historic drinking water source in the region, although a majority (68%) of participants reported switching to reverse osmosis water during study follow ups. Participants who reported ever drinking from well water had estimated glomerular filtration rates −6.7 (SD: 2.8) ml/min/1.73m2 lower than participants who did not drink from well water historically (p = 0.0184) during the study period. Geospatial analysis identifies a cluster within the region where CKDu progression is significantly higher than the surrounding area. Samples of household wells (n = 262) indicated 68% had detectable agrochemical compounds with concentration above global water quality standards. It is expected that the detected contaminants compounds are indicators of poor water quality and that there is likely additional agrochemical exposure including commercial additives that may contribute to CKDu onset and/or progression. Thus, our study finds that well water exposure during a person's lifetime in this region is associated with kidney function decline and identifies and quantifies putative nephrotoxic agrochemicals above safe drinking water concentrations in these wells.

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Urban Flood Modeling Application: Assess the Effectiveness of Building Regulation in Coping with Urban Flooding Under Precipitation Uncertainty

Sustainable Cities and Society, Vol 75 Art No. 103294

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Abstract

This research evaluates the effectiveness of planning and building regulations in coping with urban flooding under different precipitation scenarios. Accordingly, the study simulated seven alternative scenarios considering the variations of precipitation, plot coverage regulations, and Low Impact Development (LID) options. The study utilized open-source geospatial software to model different surface runoff scenarios. Then the effectiveness of those seven alternatives was assessed by utilizing the Analytical Hierarchy Process (AHP) technique to evaluate their sustainability in urban design. The results revealed that the plot coverage regulations are effective in managing floods during average rainfall events, and LID-based infrastructure solutions are effective during moderate rainfall events. Nevertheless, none of these solutions were solely adequate during extreme rainfall events. Regardless of the response to extreme rainfall occurrences, the practitioners' opinion was in favour of green roof adoption and plot coverage regulation considering their effectiveness in managing more frequent average rainfall events, and the overall sustainability in maintaining the balance of urban hydrological pathways. Accordingly, the findings of the study can be utilized as a guide to the decision-making process in urban planning and design, and to formulate sustainable planning regulations and guidelines to cope with urban flooding under the precipitation uncertainty.

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$K_2Mn_3[Fe^{II}(CN)_6]_2$ NPs with High T_1-Relaxivity Attributable to Water Coordination on the Mn(II) Center for Gastrointestinal Tract MR Imaging

Advanced Healthcare Materials, Vol 10, Iss 20, Art No. 2100987

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Abstract

The lack of acid stability in the stomach and of temporal stability when moving through the gastrointestinal (GI) tract has made the development of oral magnetic resonance imaging (MRI) contrast agents based on the platform of Gd^{3+} –complexes problematic. On the other hand, the negative contrast enhancement produced by the T_2-weighted magnetic metal oxide nanoparticles (NPs) often renders the image readout difficult. Biocompatible NPs of the manganese Prussian blue analog $K_2Mn_3[Fe^{II}(CN)_6]_2$ exhibit extremely high stability under the acidic conditions of the gastric juice. Additionally, the high r_1 relaxivity, low toxicity, and high temporal stability of such NPs offer great potential for the development of a true T_1-weighted oral contrast agent for MRI of the entire GI tract.

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Modeling of thermochemical conversion of waste biomass – a comprehensive review

Biofuel Research Journal, Vol 32, pp 1481-1528

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Abstract

Thermochemical processes, which include pyrolysis, torrefaction, gasification, combustion, and hydrothermal conversions, are perceived to be more efficient in converting waste biomass to energy and value-added products than biochemical processes. From the chemical point of view, thermochemical processes are highly complex and sensitive to numerous physicochemical properties, thus making reactor and process modeling more challenging. Nevertheless, the successful commercialization of these processes is contingent upon optimized reactor and process designs, which can be effectively achieved via modeling and simulation. Mode ls of various scales with numerous simplifying assumptions have been developed for specific applications of thermochemical conversion of waste biomass. However, there is a research gap that needs to be explored to elaborate the scale of applicability, limitations, accuracy, validity, and special features of each model. This review study investigates all above mentioned important aspects and features of the existing models for all established industrial thermochemical conversion processes with emphasis on waste biomass, thus addressing the research gap mentioned above and presenting commercial-scale applicability in terms of reactor designing, process control and optimization, and potential ways to upgrade existing models for higher accuracy.

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An integrated approach of rice hull biochar-alternative water management as a promising tool to decrease inorganic arsenic levels and to sustain essential element contents in rice

Journal of Hazardous Materials, Vol 405, Art No.124188

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Abstract

Arsenic (As) in rice agroecosystems causes a loss of both rice yield and quality of rice grains. In this study, an integrated approach of biochar (BC) and alternative water management is proposed to reduce As content while sustaining essential elemental concentrations in rice. The rice cultivar, *Jayanthi*, was grown, irrigated with 1 mg L^{-1} of As-containing water, under rice hull BC (RBC)-flooded, RBC-intermittent, conventional flooded, and intermittent treatments. The RBC has increased rice yield by 11% 19% in RBC-intermittent and -flooded treatments compared to the flooded treatment. Inorganic As content in rice tissues and abundance of Fe(III) reducing bacteria in the rhizosphere were lowered by 10% – 83% and 40 –70%, respectively, in RBC-flooded, -intermittent, and intermittent treatments over flooded treatment. Essential elemental concentrations (Fe, Mn, Zn, Mg, and Ca) in unpolished rice grains increased by 45% – 329% in RBC-flooded and -intermittent treatments compared to flooded treatment. Overall, the integrated approach of RBC-intermittent practices has lowered inorganic As concentration in unpolished rice grains, while sustaining the levels of essential elements in rice grains, compared to other treatments. An integrated approach of RBC-intermittent practices is suggested for rice grown with As-contaminated water to improve the quality of rice, as well as tackling food-related malnutrition in people.

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Profiles of antibiotic resistome and microbial community in groundwater of CKDu prevalence zones in Sri Lanka

Journal of Hazardous Materials, Vol 403, pp 123816

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Abstract

The chronic kidney disease of unknown etiology (CKDu) prevalent in certain regions of Sri Lanka poses a serious threat to human health. Previous epidemiological studies focused on the search of causative agents for CKDu etiology from the viewpoint of groundwater composition, but how CKDu prevalence affected the groundwater microbial composition, especially the antibiotic resistome, has never been illuminated. This study investigated the response of microbial community and antibiotic resistome to CKDu prevalence in the groundwater through the high throughput sequencing and qPCR (HT-qPCR), respectively. Results showed that CKDu prevalence significantly influenced the distribution of antibiotic resistome and microbial community composition. The *mexF* dominated in all the groundwater samples and could be considered as an intrinsic ARG, and the β-lactamase *cphA* was specially enriched and closely associated with the antibiotics used for CKDu patients. The *Acinetobacter* was a potential human pathogen common in the groundwater of CKDu affected regions, while CKDu prevalence specially enriched the *Aeromonas*. Statistical analysis indicated that CKDu prevalence impacted antibiotic resistome through the microbial community as a whole, and MGEs contributed to the occurrence of *mexF*, while the enrichment of *cphA* could be attributed to the increase of *Aeromonas*.

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Mitigation of petroleum-hydrocarbon-contaminated hazardous soils using organic amendments: A review

Journal of Hazardous Materials, Vol 403, pp 123816

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Abstract

The term "Total petroleum hydrocarbons" (TPH) is used to describe a complex mixture of petroleum -based hydrocarbons primarily derived from crud e oil. Those compounds are considered as persistent organic pollutants in the terrestrial environment. A wide array of organic amendments is increasingly used for the remediation of TPH-contaminated soils. Organic amendments not only supply a source of carbon and nutrients but also add exogenous beneficial microorganisms to enhance the TPH degradation rate, thereby improving the soil health. Two fundamental approaches can be contemplated within the context of remediation of TPH-contaminated soils using organic amendments: (i) enhanced TPH sorption to the exogenous organic matter (immobilization) as it reduces the bioavailability of the contaminants, and (ii) increasing the solubility of the contaminants by supplying desorbing agents (mobilization) for enhancing the subsequent biodegradation. Net immobilization and mobilization of TPH have both been observed following the application of organic amendments to contaminated soils. This review examines the mechanisms for the enhanced remediation of TPH-contaminated soils by organic amendments and discusses the influencing factors in relation to sequestration, bioavailability, and subsequent biodegradation of TPH in soils. The un certainty of mechanisms for various organic amendments in TPH remediation processes remains a critical area of future research.

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Stator-Flux-Linkage-Calculation-Based Torque Estimation of Induction Motors Considering Iron, Mechanical, and Stray Load Losses

IEEE Transactions on Industry Applications, Vol 57, Iss 6, pp 5916 – 5926

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Abstract
This article presents a method to estimate the average torque of a V / f -controlled induction motor (IM) accurately from stator flux linkage and stator current vectors. This method is based on stator flux linkage calculation by a dc-offset-less approximation integrator with error compensator considering not only no-load iron and mechanical losses but also stray load loss. Based on loss analysis, we point out the necessity of considering the iron loss, mechanical loss, and stray load loss caused by the fundamental wave power as additional losses in order to improve the torque estimation accuracy of the proposed method. This article also shows a new method to take the stray load loss into account using linearity of torque and rotor current. The proposed method can be performed without a torque meter and is applicable to both sinusoidal and inverter drives. The proposed torque estimation is implemented on two squirrel-cage IMs: a semiclosed rotor machine and a closed-slot rotor machine, fed by sinusoidal-, square-, and pulsewidth-modulation-wave drives. The result of the estimated torque is verified by comparing the estimated and measured torques.

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Endemicity and land-use type influence the abundance– range-size relationship of birds on a tropical island

Journal of Animal Ecology, Vol 90, Iss 2, pp 460-470

Rachakonda Sreekar, Katerina Sam, Salindra K. Dayananda, Uromi Manage Goodale, Sarath W. Kotagama, Eben Goodale

Abstract

1. A single adverse environment event can threaten the survival of small-ranged species while random fluctuations in population size increase the extinction risk of less-abundant species. The abundance–range-size relationship (ARR) is usually positive, which means that smaller-ranged species are often of low abundance and might face both problems simultaneously.
2. The ARR has been reported to be negative on tropical islands, perhaps allowing endemic species in such environments to remain extant. But there is a need to understand how endemism and land-use interact to shape ARR.
3. Using 41 highly replicated transects along the full elevational gradient of Sri Lanka, we determined the following: (a) the direction of ARR, (b) if endemism affects ARR and (c) if land-use (rainforest, buffer and agriculture) changes ARR differently for endemics and non-endemics. Additionally, (d) we identified endemics that had both lower abundances and smaller range sizes, and ranked them from most threatened (specific to rainforests) to least threatened using a weighted-interaction nestedness estimator.
4. (a)We found a positive relationship between species abundances and range size. This positive ARR was maintained among endemic and non-endemic species, across land-use types and at local and regional scales. (b) The ARR interacted with endemicity and land-use. Endemics with smaller range sizes had higher abundances than non-endemics, and particularly higher in rainforests compared to agriculture. In contrast, species with larger range sizes had similar abundances across endemicity and land-use categories. Many endemics with smaller range sizes are globally threatened; therefore, higher abundances may buffer them from extinction risks. (c) Nine (29%) endemics had both below average abundance and elevational range size. The nestedness estimator ranked the endemics Sri Lanka Whistling Thrush *Myophonus blighi*, Red-faced Malkoha *Phaenicophaeus pyrrhocephalus*, Sri Lanka Thrush *Zoothera imbricata* and White-faced Starling *Sturnornis albofrontus* as the four most vulnerable species to local extinction risk, which corresponds to their global extinction risk.
5. We demonstrate that ARR can be positive on tropical islands, but it is influenced by endemism and land-use. Examining shifts in ARR is not only important to understand community dynamics but can also act as a tool to inform managers about species that require monitoring programmes.

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HLA-DR Marks Recently Divided Antigen-Specific Effector CD4 T Cells in Active Tuberculosis Patients

Journal of Immunology, Vol 207, Iss 2, pp 523–533

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Abstract

Upon Ag encounter, T cells can rapidly divide and form an effector population, which plays an important role in fighting acute infections. In humans, little is known about the molecular markers that distinguish such effector cells from other T cell populations. To address this, we investigated the molecular profile of T cells present in individuals with active tuberculosis (ATB), where we expect Ag encounter and expansion of effector cells to occur at higher frequency in contrast to *Mycobacterium tuberculosis* sensitized healthy $IGRA^+$ individuals. We found that the frequency of $HLA\text{-}DR^+$ cells was increased in circulating CD4 T cells of ATB patients, and was dominantly expressed in *M. tuberculosis* Ag-specific CD4 T cells. We tested and confirmed that HLA-DR is a marker of recently divided CD4 T cells upon M. tuberculosis Ag exposure using an in vitro model examining the response of resting memory T cells from healthy $IGRA^+$ to Ags. Thus, HLA-DR marks a CD4 T cell population that can be directly detected ex vivo in human peripheral blood, whose frequency is increased during ATB disease and contains recently

divided Ag-specific effector T cells. These findings will facilitate the monitoring and study of disease-specific effector T cell responses in the context of ATB and other infections.

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Immune Responses to a Single Dose of the AZD1222/Covishield Vaccine at 16 Weeks in Individuals in Sri Lanka

The Journal of Immunology, Vol 207, Iss 11, pp 2681–2687

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Abstract

Due to limited access to vaccines, many countries have only administered a single dose of the AZD1222, whereas the dosage intervals have increased ≥4 wk. We sought to investigate the immunogenicity of a single dose of vaccine at ≥16 wk postimmunization. Severe acute respiratory syndrome coronavirus 2-specific Abs in 553 individuals and Abs to the receptor-binding domain of the Wuhan virus (wild-type) and the variants of concern, angiotensin-converting enzyme 2 receptor blocking Abs ex vivo and cultured IFN-γ T cell (*Homo sapiens*) responses and B cell (*H. sapiens*) ELISPOT responses, were investigated in a subcohort. The seropositivity rates in those >70 y of age (93.7%) was not significantly different compared with other age groups (97.7-98.2; Pearson $\chi^2 = 7.8$; $p = 0.05$). The Ab titers (Ab index) significantly declined ($p < 0.0001$) with increase in age. A total of 18 of 69 (26.1%) of individuals did not have angiotensin-converting enzyme 2 receptor-blocking Abs, whereas responses to the receptor-binding domain of wild-type ($p = 0.03$), B.1.1.7 ($p = 0.04$), and B.1.617.2 ($p = 0.02$) were significantly lower in those who were >60 y. Ex vivo IFN-γ T cell ELISPOT responses were seen in 10 of 66 (15.1%), whereas only a few expressed CD107a. However, >85% had a high frequency of cultured IFN-γ T cell ELISPOT responses and B cell ELISPOTs. Virus-specific Abs were maintained at ≥16 wk after receiving a single dose of AZD1222, although levels were lower to variants of concern, especially in older individuals. A single dose induced a high frequency of memory T and B cell responses.

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Propensity and appraisal of biochar performance in removal of oil spills: A comprehensive review

Environmental Pollution, Vol 288, Art No. 117676

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Abstract

Recently, the adsorption-based environmental remediation techniques have gained a considerable attention, due to their economic viability and simplicity over other methods. Hence, detailed presentation and analysis were herein focused on describing the role of biochar in oil spill removal. Oil removal by utilizing biochar is assumed as a green-oriented concept. Biochar is a carbon-rich low-cost material with high porosity and specific surface chemistry, with a tremendous potentiality for oil removal from aqueous solutions. Oil sorption properties of biochar mainly depend on the biochar production/synthesis method, and the biomass feedstock type. In order to preserve the stability of functional groups in the structure, biochar needs to be produced/activated at low temperatures (<700 °C). In general, biochar derived from biomass containing high lignin content via slow pyrolysis is more favorable for oil removal. Exceptional characteristics of biochar which intensify the oil removal capability such as hydrophobicity, oleophilicity or/and specific contaminant-surface interaction of biochar can be enhanced and be tuned by chemical and physical activation methods. Considering all the presented results, future perspectives such as the examination of biochar efficacy on oil removal efficiency in multi-element contaminated aqueous solutions to identify the best biomass feedstocks, the production protocols and large- scale field trials, are also discussed.

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Phosphorus mobilization in unamended and magnesium sulfate-amended soil monoliths under simulated snowmelt flooding

Environmental Pollution, Vol 287, Art No. 117619

Udaya W.A. Vitharana, Darshani Kumaragamage, B. L. W. K. Balasooriya, Srimathie P. Indraratne, Doug Goltz

Abstract

Enhanced release of phosphorus (P) from soils with snowmelt flooding poses a threat of eutrophication to waterbodies in cold climatic regions. Reductions in P losses with various soil amendments has been reported, however effectiveness of $MgSO_4$ has not been studied under snowmelt flooding. This study examined (a) the P release enhancement with flooding in relation to initial soil P status and (b) the effectiveness of $MgSO_4$ at two rates in reducing P release to floodwater under simulated snowmelt flooding. Intact soil monoliths were collected from eight agricultural fields from Southern Manitoba, Canada. Unamended and $MgSO_4$ surface-amended monoliths (2.5 and 5.0 Mg ha^{-1}) in triplicates were pre-incubated for 7 days, then flooded and incubated (4 ◦C) for 56 days. Pore water and floodwater samples collected at 7-day intervals were analyzed for dissolved reactive P (DRP), pH, Ca, Mg, Fe and Mn. Redox potential (Eh) was measured on each day of sampling. Representative soil samples collected from each field were analyzed for Olsen and Mehlich 3-P. Simulated snowmelt flooding enhanced the mobility of soil P with approximately 1.2–1.6 -fold increase in pore water DRP concentration from 0 to 21 days after flooding. Mehlich-3 P content showed a strong relationship with the pore water DRP concentrations suggesting its potential as a predictor of P loss risk during prolonged flooding. Surface application of $MgSO_4$ reduced the P release to pore water and floodwater. The 2.5 Mg ha^{-1} rate was more effective than the higher rate with a 21-75% reduction in average pore water DRP, across soils. Soil monoliths amended with $MgSO_4$ maintained a higher Eh, and had greater pore water Ca and Mg concentrations, which may have reduced redox-induced P release and favored re-precipitation of P with Ca and Mg, thus decreasing DRP concentrations in pore water and floodwater.

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Iron modification to silicon-rich biochar and alternative water management to decrease arsenic accumulation in rice (*Oryza sativa* L.)

Environmental Pollution, Vol 286, Art No. 117661

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Abstract

Production of rice grains at non-toxic levels of arsenic (As) to meet the demands of an ever-increasing population is a global challenge. There is currently a lack of investigation into integrated approaches for decreasing As levels in rice agro-ecosystems. By examining the integrated iron-modified rice hull biochar (Fe-RBC) and water management approaches on As dynamics in the paddy agro-ecosystem, this study aims to reduce As accumulation in rice grains. The rice cultivar, *Ishikari*, was grown and irrigated with As-containing water (1 mg L^{-1} of As(V)), under the following treatments: (1) Fe-RBC-flooded water management, (2) Fe-RBC-intermittent water management, (3) conventional flooded water management, and (4) intermittent water management. Compared to the conventional flooded water management, grain weight per pot and Fe and Si concentrations in the paddy pore water under Fe-RBC-intermittent and Fe-RBC-flooded treatments increased by 24%–39%, 100%–142%, and 93%–184%, respectively. The supplementation of Fe-RBC decreased the As/Fe ratio and the abundance of Fe(III) reducing bacteria (i.e. *Bacillus, Clostridium, Geobacter, and Anaeromyxobacter*) by 57%–88% and 24%–64%, respectively, in Fe-RBC-flooded and Fe-RBC-intermittent treatments compared to the conventional flooded treatment. Most importantly, Fe-RBC-intermittent treatment significantly ($p \leq 0.05$) decreased As accumulation in rice roots, shoots, husks, and unpolished rice grains by 62%, 37%, 79%, and 59%, respectively, compared to the conventional flooded treatment. Overall, integrated Fe-RBC-intermittent treatment could be proposed for As endemic areas to produce rice grains with safer As levels, while sustaining rice yields to meet the demands of growing populations.

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From mine to mind and mobiles – Lithium contamination and its risk management

Environmental Pollution, Vol 290, Art No. 118067

Nanthi Bolan, Son A. Hoang, Mohsin Tanveer, Lei Wang, Shiv Bolan, Prasanthi iSooriyakumar, Brett Robinsoni, Hasintha Wijesekara, Madhuni Wijesooriya, S. Keerthanan, Meththika Vithanage, Bernd Markert, Stefan Franzle, Simone Wünschmann, Binoy Sarkar, Ajayan Vinu, M.B. Kirkham, Kadambot H.M. Siddique, Jorg Rinklebe

Abstract

With the ever-increasing demand for lithium (Li) for portable energy storage devices, there is a global concern associated with environmental contamination of Li, via the production, use, and disposal of Li-containing products, including mobile phones and mood-stabilizing drugs. While geogenic Li is sparingly soluble, Li added to soil is one of the most mobile cations in soil, which can leach to groundwater and reach surface water through runoff. Lithium is readily taken up by plants and has relatively high plant accumulation coefficient, albeit the underlying mechanisms have not been well described. Therefore, soil contamination with Li could reach the food chain due to its mobility in surface- and ground-waters and uptake into plants. High environmental Li levels adversely affect the health of humans, animals, and plants. Lithium toxicity can be considerably managed through various remediation approaches such as immobilization using clay-like amendments and/or chelate-enhanced phytoremediation. This review integrates fundamental aspects of Li distribution and behaviour in terrestrial and aquatic environments in an effort to efficiently remediate Li-contaminated ecosystems. As research to date has not provided a clear picture of how the increased production and disposal of Li-based products adversely impact human and ecosystem health, there is an urgent need for further studies on this field.

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Prevalence of different states of glucose intolerance in Sri Lankan children and adolescents with obesity and its relation to other comorbidities

Pediatric Diabetes, Vol 22, pp 168–181

Iris Ciba, Loretta S. Warnakulasuriya, Adikaram V. N. Adikaram, Peter Bergsten, Marie Dahlbom, Manel M. A. Fernando, Elisabet Rytter, Dulani L. Samaranayake, K. D. Renuka Ruchira Silva, V. Pujitha Wickramasinghe, Anders H. Forslund

Abstract

Background

South Asian adults have higher prevalence of obesity comorbidities than other ethnic groups. Whether this also is true for Sri Lankan children with obesity has rarely been investigated.

Objective

To investigate prevalence of glucose intolerance and other comorbidities in Sri Lankan children with obesity and compare them with Swedish children. To identify risk factors associated with glucose intolerance.

Subjects

A total of 357 Sri Lankan children (185 boys), aged 7 to 17 years with BMI-SDS ≥2.0 from a cross-sectional school screening in Negombo. A total of 167 subjects from this study population were matched for sex, BMI-SDS and age with 167 Swedish subjects from the ULSCO cohort for comparison.

Methods

After a 12 hour overnight fast, blood samples were collected and oral glucose tolerance test was performed. Body fat mass was assessed by bioelectrical impedance assay. Data regarding medical history and socioeconomic status were obtained from questionnaires.

Results

Based on levels of fasting glucose (FG) and 2 hours-glucose (2 hours-G), Sri Lankan subjects were divided into five groups: normal glucose tolerance (77.5%, n = 276), isolated impaired fasting glucose according to ADA criteria (9.0%, n = 32), isolated impaired glucose tolerance (8.4%, n = 30), combined impaired fasting glucose (IFG) + impaired glucose tolerance (IGT) (3.1%, n = 11) and type 2 diabetes mellitus (2.0%, n = 7). FG, 2 hours-insulin and educational status of the father independently increased the Odds ratio to have elevated 2 hours-G. Sri Lankan subjects had higher percentage of body fat, but less abdominal fat than Swedish subjects.

Conclusion

High prevalence in Sri Lankan children with obesity shows that screening for glucose intolerance is important even if asymptomatic.

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Pediatric diabetes care in Sri Lanka and Bangladesh: Reaching the community

Pediatric Diabetes, Vol 22, Iss 1, pp 112-115

Navoda Atapattu, Fauzia Mohsin, Bedowra Zabeen, Sumudu Nimali Seneviratne

Abstract

Diabetes is a major non-communicable disease with long-term complications. Over one million children and adolescents are affected with type 1 diabetes in the world. The number of children and adolescents with type 2 diabetes is also on the rise due to the increase incidence of childhood diabetes. South East Asian (SEA) contributes 184,100 children and adolescents with type 1 diabetes under the age of 20 years for this global health issue as at 2019. Countries of SEA region share same socio demo-graphic, cultural, and economic challenges when it comes to holistic care of affected children. It is timely to discuss common concerns of these countries to give the best possible care for children affected with diabetes to minimize the burden of diabetes related complications, which would potentially affect the socioeconomic development of the respective countries.

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Compost as a carrier for microplastics and plastic-bound toxic metals into agroecosystems

Current Opinion in Environmental Science and Health, Vol 24, Art No. 100297

Meththika Vithanage, Sammani Ramanayaka, Sandeep Hasinthara, Ayanthi Navaratne

Abstract

Research on microplastics (MPs) primarily focuses on the abundance in different ecosystems, ecotoxicology, and health aspects. The primary focus is now on structural and physicochemical changes in soil, ecotoxicology, and influence on plant growth performance. Compost is considered one of the prime sources of MPs in agricultural environments, where MPs in compost can influence the carbon cycle in copious ways, such as soil microbial processes, plant growth, or litter decomposition. Microplastics are reported in the range of 10–2800 item kg^{-1} in compost from various countries. Most importantly, compost can be a carrier for MP-bound toxic trace metals into the agroecosystems. It has been identified that different toxic metals are associated with the MPs in compost, i.e. Cr, Pb, Cu and Ni; however, no considerable attention is given to the study of their concentrations, translocation, and fate. As the addition of MPs changes the physical, chemical, and biological properties of soil, which leads to a change in toxic trace metal fractionation and partitioning, as reported in the literature. Importantly, future research needs to capture the toxic metal mobilization and immobilization in terms of chemistry, aging, size, aggregation, and shape of MPs.

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The link between corporate energy management and environmental strategy implementation: Efficiency, sufficiency and consistency strategy perspectives

Journal of Cleaner Production, Vol 293, Art No. 126082

Nuwan Gunarathne, Ki-Hoon Lee

Abstract

In managing energy, companies face numerous challenges arising as a result of the imperfections and inaccuracies of the information on the subject. This study examines the uses of energy information in corporate energy management strategies from an environmental strategy implementation perspective. Based on 18 commercial and industrial sector businesses in Sri Lanka, the study develops an analytical framework combining the use of information in three energy management strategies (i.e., efficiency, sufficiency, and consistency) in organizations at different levels of environmental strategy implementation (i.e., reactive, preventive and proactive strategies). The study has identified a wide range of energy information uses for organizational efficiency within all environmental strategies. However, the findings reveal limited, and ad hoc energy information uses for sufficiency and consistency strategies of the organizations that pursue reactive and preventive strategies. The lack of systematic energy information management systems points to the vast potential for organizations, particularly in the early stages of environmental strategy implementation, to achieve corporate energy sustainability. This study also highlights the practical implications of the key actors in energy management, such as government bodies and policymakers, practitioners in the corporate sector, and industry chambers.

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Recent advances on high performance machining of aerospace materials and composites using vegetable oil-based metal working fluids

Journal of Cleaner Production, Vol 310, Art No. 127459

K.C. Wickramasinghe, Hiroyuki Sasahara, Erween Abd Rahim, G.I.P. Perera

Abstract

A comprehensive analysis of the archival literature on sustainable (i.e., socioeconomic, and environmental friendly) machining of advanced aerospace materials and composites has been performed. Specifically, the paper focuses on the techniques to improve the machinability of difficult to cut materials (Steel alloys, Ni-based super alloys, Ti-based alloys, and composites) frequently consume in aerospace manufacturing industry. The current industrial requirement on high-performance sustainable machining of advanced super alloys and composites have been addressed for the machining process optimization to gain reasonable profit margin. Here, the specific interest areas are formulation of high-performance vegetable oil-based metalworking fluid (MWF), health and environmental conscious machining of difficult to cut materials and future perspectives on biodegradable MWFs on machining advanced aerospace materials and composites. The proposed approaches of the sustainable and cleaner production for the above-mentioned areas involves the occupational health and safety, minimum waste (i.e., effluent) generation, elimination of the environment pollution (i.e., MWF usage and disposal phases) and high-performance machining. Additionally, the influence of tribological properties of vegetable oil based MWFs on thermophysical characteristics of difficult to cut materials have been critically reviewed. The study presented in the paper is timely valuable due to the rapid increment of the demand on sustainable machining requirement in difficult to cut materials. Moreover, the presented comprehensive analysis, proposed suggestions and recommendations will help the next generation scientists to find the recent advances as well as future avenues of research on high performance sustainable machining of advanced aerospace materials and composites (i.e., category of difficult to cut materials) to ensure process optimization and industrial sustainability.

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A systematic review of the life cycle inventory of clothing

Journal of Cleaner Production, Vol 320, Art No. 128852

Prabod Munasinghe, Angela Druckman, D.G.K. Dissanayake

Abstract

The clothing industry is a significant contributor to environmental degradation. Many life cycle assessment (LCA) studies have been conducted to analyse its environmental impacts, however the majority of studies focus on either just one or a few stages of the product life cycle, and/or on a specific type of product. Therefore, easily accessible life cycle inventory (LCI) data that can be used in decision making by practitioners and researchers are lacking. This study addresses this gap. By collating data through a systematic literature review and meta-analysis, it provides LCI data on energy use, water use and greenhouse gas emissions for a range of materials across all stages of the life cycle on a consistent basis. A framework is developed that groups each material at each life cycle stage according to the intensity of its energy and water use, and greenhouse gas emissions. The analysis revealed that the raw material extraction stage generally has the highest environmental impact. In this life cycle stage, flax is the virgin fibre with the lowest environmental impacts, recycled cotton is the recycled fibre which has the lowest environmental impacts and Indian silk is found to have the highest impacts. The review identifies the gaps in the availability of LCI data and provides recommendations for LCA studies to address these gaps, as without comprehensive data, robust decisions cannot be made. The results presented in this paper must be looked at in the wider context of consumption: the best way to reduce impacts is to reduce consumption. However, noting that production cannot be reduced to zero, the results of this study will aid pro-environmental decision making by stakeholders of the fashion industry, such as designers and consumers, as well as being of use to researchers.

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Corporate cleaner production strategy development and environmental management accounting: A contingency theory perspective

Journal of Cleaner Production, Vol 308, Art No. 127402

Nuwan Gunarathne, Ki-Hoon Lee

Abstract

Despite the popularity of environmental management accounting as an approach to support corporate cleaner production measures, so far, how the environmental management accounting implementation differs according to the stage of cleaner production strategy development is largely unknown. This study thus sought to identify how the uses of environmental management accounting and information characteristics vary among organizations at different stages of cleaner production strategy development. Drawing on the contingency theory view of environmental management accounting system sophistication, cleaner production strategy development stages, and environmental management accounting uses, it developed an analytical framework. Based on eighteen case studies of business in Sri Lanka, the study analyzed the different domain-based and functional uses of environmental management accounting and their characteristics according to their cleaner production strategy development (i.e., reactive, preventive and proactive stages). Overall, the study found that environmental management accounting uses to be limited and fragmented in organizations at the reactive and preventive stages except for using environmental management accounting for cost savings and efficiency improvements. However, the findings suggest that as and when organizations progress into higher levels of cleaner production strategy development, there is a relatively high level of use of environmental management accounting in terms of integrative tools, and for control and stewardship purposes.

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Life-cycle costs of a resource-oriented sanitation system and implications for advancing a circular economy approach to sanitation

Journal of Cleaner Production, Vol 307, Art No. 127135

Naomi Carrard, Nilanthi Jayathilake, Juliet Willetts

Abstract
Implementing a circular economy approach to sanitation requires knowledge of the costs to construct, operate and maintain resource-oriented systems. Yet the dearth of data on costs of urban sanitation in general, and resource-oriented systems in particular, limit opportunities to progress sustainable sanitation in low- and middle-income countries. This paper contributes empirical data on the life-cycle costs of a resource-oriented sanitation system in urban Sri Lanka, addressing a gap in evidence about how much it costs, and who pays, for a system that integrates fecal sludge management with nutrient capture and reuse. Costs across the system life-cycle were analyzed according to: (i) cost type; (ii) phases of the sanitation chain; and (iii) distribution between actors. Over a 25-year lifespan, the system had an annualized cost of USD 2.8/person or USD 11/m^3 of septage treated. Revenue from co-compost sales covered reuse-related costs plus 8% of present value costs for other phases of the sanitation chain. Findings affirm both the potential for resource-oriented sanitation to generate revenue, and the need for substantial complementary investment in the overall system. The system was found to be reliant on household investment, yet financially viable from the service provider perspective with revenue from desludging services (89%) and co-compost sales (11%) that exceeded costs over the system lifespan and in most years. The analysis of total costs, financial perspectives, and reuse specifics contributes critical evidence to inform policy and planning that supports a purposeful and equitable transition towards circular economy approaches to sanitation.

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Diffusion of cleaner production in a developing country: The case of Sri Lanka

Journal of Cleaner Production, Vol 311, Art No. 127626

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Abstract

For developing countries, cleaner production plays a significant role in transitioning corporates, governments, and societies' alignment with sustainable development goals. However, studies of cleaner production in developing countries provide a narrow view on scope, content, sectors and actors without describing the dynamic trajectory of their evolutionary process. A broader understanding of cleaner production diffusion is vital in not only contributing to the policy-level developments but also facilitating wider and strategic adoption by firms. Therefore, this study was conducted to provide an in-depth analysis of how and why cleaner production, as a managerial technology, is diffused in developing countries by focusing on the context of Sri Lanka. Using a case study approach, data was collected from multiple sources in the Sri Lankan cleaner production industry. The data were analyzed by considering the demand-pull and supply-push factors through the diffusion theory of innovation lenses. The findings indicate that Sri Lanka is witnessing hierarchical diffusion; cleaner production is being trickled down from highly polluting industries and export-oriented sectors to other peripheral sectors due to various factors, including efficient choices, forced selection, and fashion. The supply-side propagators have played a crucial role in popularizing and advocating for cleaner production to accelerate the diffusion process. While the proactive firms have elevated their practices to organization-wide sustainable development strategies, the reactive users practice cleaner production only as an isolated and ad-hoc exercise. This paper contributes as a general reference for policy-level developments and interventions for various stakeholder groups to promote cleaner production in developing countries.

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Performance based energy, ecological and financial costs of a sustainable alternative cement

Journal of Cleaner Production, Vol 287, Art No. 125035

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Abstract
This paper presents a comparison of the energy and ecological impacts and financial costs of Alkali Pozzolan Cement (APC), High Volume Fly Ash (HVFA) cement and Ordinary Portland Cement (OPC) mixtures. The embodied energy, carbon dioxide emission and financial costs were calculated per unit weight of dry binder powder; per unit volume per unit strength of hydrated hardened binder; and finally per unit volume per unit strength per year of service. The performance-based indicators therefore consider both strength and durability; with the latter based both on carbonation and chloride environments. The statistical means and variability of the costs were also computed. The results indicate that the energy, ecological and financial costs of APC are very attractive compared to those of OPC or HVFA, when considered either as the cost per unit weight of binder or as the cost per unit performance, whether related to unit strength or both unit strength and year of service. The variability of the APC cost indicators was also the lowest in general among the cements considered. However, OPC is still arguably the best when only carbonation exposure is involved during service.

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Recent insights into the metabolic adaptations of phosphorus-deprived plants

Journal of Experimental Botany, Vol 72, Iss 2, pp 199–223

D.M. S. B. Dissanayaka, Mina Ghahremani, Meike Siebers, Jun Wasaki, William C. Plaxton

Abstract

Inorganic phosphate (Pi) is an essential macronutrient required for many fundamental processes in plants, including photosynthesis and respiration, as well as nucleic acid, protein, and membrane phospholipid synthesis. The huge use of Pi-containing fertilizers in agriculture demonstrates that the soluble Pi levels of most soils are suboptimal for crop growth. This review explores recent advances concerning the understanding of adaptive metabolic processes that plants have evolved to alleviate the negative impact of nutritional Pi deficiency. Plant Pi starvation responses arise from complex signaling pathways that integrate altered gene expression with post-transcriptional and post-translational mechanisms. The resultant remodeling of the transcriptome, proteome, and metabolome enhances the efficiency of root Pi acquisition from the soil, as well as the use of assimilated Pi throughout the plant. We emphasize how the up-regulation of high-affinity Pi transporters and intra- and extracellular Pi scavenging and recycling enzymes, organic acid anion efflux, membrane remodeling, and the remarkable flexibility of plant metabolism and bioenergetics contribute to the survival of Pi-deficient plants. This research field is enabling the development of a broad range of innovative and promising strategies for engin-eering phosphorus-efficient crops. Such cultivars are urgently needed to reduce inputs of unsustainable and non-renewable Pi fertilizers for maximum agronomic benefit and long-term global food security and ecosystem preservation.

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Hydrodynamic analysis of a novel wave energy converter: Hull Reservoir Wave Energy Converter (HRWEC)

Renewable Energy, Vol 170, pp 1020-1039

S.D.G.S.P. Gunawardane, G.A.C.T. Bandara, Young-Ho Lee

Abstract

This paper introduces a novel concept of flap-type wave energy device named the Hull Reservoir Wave Energy Converter (HRWEC). The device is a hybrid of the Pendulum type wave energy converter (PeWEC) and the Pendulor wave energy converter. The device mainly consists of a floating reservoir and a top hinged flap that hangs inside the reservoir. The flap motion is triggered by both the float motion and the fluid motion inside the reservoir and the energy take-off happens through the relative motion between the flap and the float. Because this concept closely resembles the PeWEC, a similar float design is used in the HRWEC to facilitate comparison with available data. The dynamics and power capture are obtained using a frequency domain model, and the power capture is maximized for damping-only control for regular waves. It is shown that this new concept exhibits a broadband response compared to the PeWEC concept, which is linked to an additional mode created by the internal water body motion. As a result, this new concept expected to be suitable candidate for applications in broadband wave climatic conditions.

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Comparative evaluation of solar PV hosting capacity enhancement using Volt-VAr and Volt-Watt control strategies

Renewable Energy, Vol 177, pp 1063-1075

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Abstract

Integration of solar photovoltaic systems to low-voltage distribution networks is witnessing an un-precedented growth in many parts of the world. Although solar photovoltaic generation is of significant benefit from a number of angles, exceedance of hosting capacity levels by such installations in low-voltage distribution networks continue to cause significant technical challenges in network operation, especially to the management of network voltage. Modern smart inverters are equipped with Volt-VAr and Volt-Watt control capabilities, which can assist in the management of network voltage levels. This paper provides a detailed analysis of the influence of different connection standards which cover these strategies on solar photovoltaic hosting capacity and their applicability in low-voltage distribution networks. Smart inverters with differing Volt-VAr and Volt-Watt control functions are modelled in the DIgSILENT PowerFactory platform. Influence of different connection standards on solar photovoltaic hosting capacity is analysed to investigate the most beneficial connection approach/es to address the issue of voltage violations. Furthermore, the work presented in this paper provides a greater under-standing on the hosting capacity improvement by employing advanced inverter control functions where such improvements are subjected to locational aspects of inverters in low-voltage distribution systems.

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Climate and intertidal zonation drive variability in the carbon stocks of Sri Lankan mangrove forests

Geoderma, Vol 389, Art No. 114929

Pestheruwe Liyanaralalage Iroshaka Gregory Marcelus Cooray, Kodikara Arachchilage Sunanda Kodikara, Marappulige Priyantha Kumara, Uthpala Indeewari Jayasinghe, Sanduni Kanishka Madarasinghe, Faird Dahdouh-Guebas, Daniel Gorman, Mark Huxham, Loku Pulukkuttige Jayatissa

Abstract

Sri Lanka is at the forefront of global mangrove conservation. It is the first country to officially protect all its remaining mangrove forests and has embarked on an ambitious plan to restore 10,000 ha of wetland during the United Nations Decade of Ecosystem Restoration. One incentive for this conservation effort is a recognition, based on research mostly done elsewhere, of the importance of mangroves for carbon sequestration and storage. However, a lack of data on Sri Lankan mangrove carbon pools, especially on soil organic carbon, has been recognized as a major impediment to national climate change mitigation strategies. The current work examined both above and below-ground carbon stocks of five important mangrove forests in Sri Lanka (Rekawa, Puttalam- Kalpitiya, Pambala-Chilaw, Batticaloa and Negombo) which are situated in the three major climate zones (dry, intermediate and wet) and therefore sample the main climatic drivers of spatial variability. Above-ground car-bon, below-ground root carbon and soil carbon stocks of mangroves in Sri Lanka ranged from 75.5 to 189.1 Mg C ha^{-1}, 7.9 to 14.3 Mg C ha^{-1} and 643.6 to 1253.6 Mg C ha^{-1}, respectively. The highest total mangrove carbon stock was recorded from the Rekawa lagoon which is in the intermediate climate zone (1455.4 Mg C ha^{-1}) while the lowest was found in the Batticaloa lagoon in the dry zone (734.7 Mg C ha^{-1}). Soil carbon stocks were substantially higher in the places where vegetation biomass and stand densities are high. Soil comprised 83–90% of the total mangrove carbon stocks at all sites, highlighting the large potential for release into the atmosphere as carbon dioxide if these habitats are disturbed. Overall, our study contributes important data that broadens our current understanding of how mangrove organic carbon pools vary spatially and with climatic zone.

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Effect of aggregate size distribution on soil moisture, soil-gas diffusivity, and N_2O emissions from a pasture soil

Geoderma, Vol 383, Art No. 114737

J.R.R.N. Jayarathne, T.K.K. Chamindu Deepagoda, Timothy J. Clough, Steve Thomas, Bo Elberling, Kathleen M. Smits

Abstract

Grazed pastures rich in nitrogen (N) from ruminant urine and fertilizer inputs are significant sources of nitrous oxide (N_2O), a highly potent greenhouse gas. Diffusion-controlled emission of N_2O from pasture systems can be described by soil-gas diffusivity (D_p/D_o), and its dependency on soil physical properties and soil moisture dynamics. But studies linking soil aggregation, soil moisture variation, D_p/D_o and N_2O emissions are lacking. Using coarse (2–4 mm) and fine (< 0.2 mm) aggregates, and seven different combinations thereof, the effect of soil aggregate size distribution on soil–water characteristic (SWC), D_p/D_o and N_2O fluxes in a pastoral soil were investigated. Sieved-repacked samples, with varying fine aggregate fractions (F = 0, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 1.0) were saturated with KNO_3 (1800 μg mL^{-1}) solution and systematically drained to nine different matric potentials (−1 kPa to −10 kPa), followed by an air-dry step (−30 kPa). At each potential, D_p/D_o and N_2O fluxes were measured. The measured SWC and SWC-derived pore-size distributions showed clear bimodal pore structures in all combinations. The highest and lowest total porosities were observed with F = 0 and 0.7, respectively. The lowest N2O peak flux was observed with F = 0.7 which also had the lowest D_p/D_o, while the highest flux among all combinations was observed in F = 1.0 at D_p/D_o = 0.002. Peak N_2O flux varied with D_p/D_o dynamics that were in turn a function of inter-aggregate pore drainage. Initially increasing the fine fraction is speculated to have enhanced nitrifier-denitrification while further increases in the fine fraction, which lowered N_2O peak emissions, were likely due to a shift from nitrifier-denitrification to denitrification and associated N_2O consumption or entrapment.

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A blockchain empowered and privacy preserving digital contact tracing platform

Information Processing and Management, Vol 58, Iss 4, Art No. 102572

Eranga Bandara, Xueping Liang, Peter Foytik, Sachin Shetty, CrissieHall, Daniel Bowden, Nalin Ranasinghe, Kasun De Zoysa

Abstract
The spread of the COVID-19 virus continues to increase fatality rates and exhaust the capacity of healthcare providers. Efforts to prevent transmission of the virus among humans remains a high priority. The current efforts to quarantine involve social distancing, monitoring and tracking the infected patients. However, the spread of the virus is too rapid to be contained only by manual and inefficient human contact tracing activities. To address this challenge, we have developed Connect, a blockchain empowered digital contact tracing platform that can leverage information on positive cases and notify people in their immediate proximity which would thereby reduce the rate at which the infection could spread. This would particularly be effective if sufficient people use the platform and benefit from the targeted recommendations. The recommendations would be made in a privacy-preserving fashion and contain the spread of the virus without the need for an extended period of potential lockdown.

Connect is an identity wallet platform which will keep user digital identities and user activity trace data on a blockchain platform using Self-Sovereign Identity (SSI) proofs. User activities include the places he/she has travelled, the country of origin he/she came from, travel and dispatch updates from the airport etc. With these activity trace records, Connect platform can easily identify suspected patients who may be infected with the COVID-19 virus and take precautions before spreading it. By storing digital identities and activity trace records on blockchain-based SSI platform, Connect addresses the common issues in centralized cloud-based storage platforms (e.g. lack of data immutability, lack of traceability).

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Risk factors for endemic chronic kidney disease of unknown etiology in Sri Lanka: Retrospect of water security in the dry zone

Science of the Total Environment, Vol 795, Art No. 148839

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Abstract

The prevalence of chronic kidney disease of unknown etiology (CKDu) is receiving considerable attention due to the serious threat to human health throughout the world. However, the roles of geo-socio-environmental factors in the prevalence of the CKDu endemic areas are still unknown. Sri Lanka is one of the countries most seriously affected by CKDu, where 10 out of 25 districts have been identified as the areas with the high prevalence of CKDu (10–20%). This review summarizes the geographical distribution of CKDu and its probable geochemical, behavioral, sociological, and environmental risk factors based on research related to hydrogeochemical influences on CKDu in Sri Lanka. More than 98% of CKDu patients have consumed groundwater as their primary water source in daily life, indicating the interactions of geogenic contaminants (such as F^-, total dissolved solids, Hofmeister ions) in groundwater is responsible for the disease. Apart from the hydrogeochemical factors, mycotoxins, cyanotoxins, use of some herbal medicines, dehydration, and exposure to agrochemicals were alleged as risk factors. Sociological factors, including poverty, living habits and anthropogenic activities, may also provoke the emergence of CKDu. Therefore, the interaction of geo-socio environmental risk factors should be sociologically and scientifically considered to prevent the prevalence of CKDu. Future in-depth studies are required to reveal the individual role of each of the postulated etiological factors, possibly using machine learning and advanced statistics.

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Hydrothermal synthesis of MnO_2/Fe(0) composites from Li-ion battery cathodes for destructing sulfadiazine by photo-Fenton process

Science of the Total Environment, Vol 774, Art No. 145776

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Abstract

Harmless treatment of antibiotics, and recovery of precious metals from the spent Li-ion battery are two typical environmental issues with rapid development of the society. Presently, we reclaimed Mn from the spent Li-ion battery cathode materials for hydrothermally synthesizing MnO_2/Fe(0) composites, which were used as the efficient heterogeneous photo-Fenton catalyst. The new composite was well characterized by X-ray diffractometer (XRD), scanning electron microscope (SEM), high resolution transmission electron microscopy (HRTEM), X-ray photoelectron spectroscopy (XPS), photoluminescence (PL) and Brunauer-Emmett-Teller (BET) methods before optimizing their usage for sulfadiazine destruction. The catalytic efficiency of the MnO_2 substrate was enhanced by impregnating different proportions of Fe(0) into the substrate. The MnO_2: Fe(0) molar ratio at 40:1 (MnO_2-40Fe) shows optimal catalytic activity. Sulfadiazine degradation by 0.2 g/L MnO_2-40Fe, 6 mM H_2O_2 in pH 3 is almost 98.6%, and it follows first-order kinetics. The MnO_2 and nano zero-valent iron synthesized using spent cathode of Li-ion batteries is equally efficient in sulfadiazine even after five times repeated use. As elucidated by mass spectroscopic data, sulfadiazine degradation by MnO_2-40Fe was a multi-faceted photo-Fenton process which results in CO_2, H_2O, NH_4^+ and SO_4^{2-} as final products. The excellent degradation perfor-mance of the as-prepared catalyst might be attributed to the introduction of nano zero-valent iron on the nanostructured MnO_2, which not only provides more active sites, but also has a synergistic effect with MnO_2 and light irradiation, leading to the generation of large amounts of activated radicals for destructing sulfadiazine. This work provides a promising method for reclamation of spent Li-ion battery cathode for environmental applications.

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Hygiene risk of waterborne pathogenic viruses in rural communities using onsite sanitation systems and shallow dug wells

Science of the Total Environment, Vol 752, Art No. 141775

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Abstract
We evaluated the hygienic influence of onsite sanitation systems (OSSs) on drinking water wells in rural Sri Lanka by determining the safe setback distance between wells and the management of OSSs. Although previous studies have used bacterial indicators such as *E. coli* to evaluate the OSS impact, these parameters cannot assess the hygiene risk for waterborne pathogenic viruses (e.g. rotaviruses). Therefore, pepper mild mottle virus was selected as an indicator of human-specific faecal virus contamination. From a viral perspective, not only can the horizontal distance between a well and the nearest OSS reasonably represent hygiene safety, but the OSS sludge management can mitigate the contamination of wells even at short distances from the OSSs. Quantitative microbial risk assessment suggests that the infection risk of rotavirus was extremely high compared to the international standard. As proper management of OSSs would be key to reducing viral risk, it is necessary to reach out to the residents who are unaware of the importance and necessity of such management.

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Proposing an ecologically viable and economically sound farming system using a matrix-based geo-informatics approach

Science of the Total Environment, Vol 794, Art No. 148788

Sumudu Senanayake, Biswajeet Pradhan, Alfredo Huete, Jane Brennan

Abstract

Healthy farming systems play a vital role in improving agricultural productivity and sustainable food production. The present study aimed to propose an efficient framework to evaluate ecologically viable and economically sound farming systems using a matrix-based analytic hierarchy process (AHP) and weighted linear combination method with geo-informatics tools. The proposed framework has been developed and tested in the Central Highlands of Sri Lanka. Results reveal that more than 50% of farming systems demonstrated moderate status in terms of ecological and economic aspects. However, two vulnerable farming systems on the western slopes of the Central Highlands, named WL1a and WM1a, were identified as very poor status. These farming systems should be a top priority for restoration planning and soil conservation to prevent further deterioration. Findings indicate that a combination of ecologically viable (nine indicators) and economical sound (four indicators) criteria are a practical method to scrutinize farming systems and decision making on soil conservation and sustainable land management. In addition, this research introduces a novel approach to delineate the farming systems based on agro-ecological regions and cropping areas using geo-informatics technology. This framework and methodology can be employed to evaluate the farming systems of other parts of the country and elsewhere to identify ecologically viable and economically sound farming systems concerning soil erosion hazards. The proposed approach addresses a new dimension of the decision-making process by evaluating the farming systems relating to soil erosion hazards and suggests introducing policies on priority-based planning for conservation with low-cost strategies for sustainable land management.

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Rice genotype's responses to arsenic stress and cancer risk: The effects of integrated birnessite-modified rice hull biochar-water management applications

Science of the Total Environment, Vol 768, Art No. 144531

Prasanna Kumarathilaka, Jochen Bundschuh, Saman Seneweera, Yong Sik Oke

Abstract

The health risks associated with ingestion of arsenic (As) via consumption of rice are a global concern. This study investigated the effects of integrated biochar (BC)-water management approaches to As stress and to associated health risks in rice. Rice cultivars, Jayanthi and Ishikari, were grown, irrigated with As-containing water (1 mg L^{-1}), under the following treatments: (1) birnessite-modified rice hull biochar (Mn-RBC) flooded water management, (2) Mn-RBC-intermittent water management, (3) conventional flooded water management, and (4) intermittent water management. Rice yield in both rice varieties increased by 10%–34% under Mn-RBC-flooded and Mn-RBC-intermittent treatments compared to the conventional flooded treatment. In most cases, inorganic As concentration in rice roots, shoots, husks, and unpolished grains in both rice varieties was significantly ($p \leq 0.05$) lowered by 20%–81%, 6%–81%, 30%–75%, and 18%–44%, respectively, under Mn-RBC-flooded, Mn-RBC intermittent, and intermittent treatments over flooded treatment. Incremental lifetime cancer risks associated with consumption of both rice varieties were also lowered from 18% to 44% under Mn-RBC-flooded, Mn-RBC intermittent, and intermittent treatments compared to flooded treatment. Overall, the integrated Mn-RBC intermittent approach can be applied to As-endemic areas to produce safer rice grains and reduce the incremental lifetime cancer risk through rice consumption.

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Psychological wellbeing and mental health amongst medical undergraduates: A descriptive study assessing more than 1,000 medical students in Sri Lanka

International Journal of Social Psychiatry, Vol 68, Iss 6, pp 1263-1269

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Abstract

Background

Studies from around the world have shown higher rates of anxiety, depression, alcohol and other drug use, and burnout in medical students.

Aims

The aim of this study was to identify the socio-demographic factors and severity of difficulties Sri Lankan medical students face regarding psychological wellbeing and burnout.

Method

This one-off survey used a cross-sectional design, assessing substance use, psychological wellbeing, and burnout using the CAGE, GHQ-12, and OLBI. The survey was open to all medical students in six universities in Sri Lanka. Chisquare analysis was used to assess the statistical significance related to categorical dependent variables and one-way ANOVA for continuous dependent variables.

Results

A higher prevalence of diagnosed mental health conditions was found following admission to the medical course in comparison prior to admission. Sixty-two percent of students had a score of more than 2 on the GHQ-12 indicating caseness. The OLBI identified exhaustion in 79% of students. The CAGE questionnaire was positive in 4.8%
of students.

Conclusions:

Only a small proportion of students are recognizing their mental health difficulties and seeking help. Further understanding is required as to why this is, as well as re-evaluation of the demands of the curriculum. Effective ways of regularly identifying and providing practical and evidence-based support for mental health problems in medical and other undergraduates need to be identified and introduced.

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The impacts of climate induced disasters on the economy: Winners and losers in Sri Lanka

Ecological Economics, Vol 185, Art No. 107043

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Abstract

This paper examines the economic impact of climate induced disasters on Sri Lanka's agricultural, industrial and services sectors and their subsectors. In doing so, it seeks to explain a central paradox – that there are winners and losers in terms of the effect of the disasters on sectoral growth. This poses problems for many developing countries which are seeking to aggressively raise economic growth targets. These targets typically do not adequately take into account the impact of climate change on growth nor that climate change likely is to have a different effect on different economic sectors. Using cross-provincial panel datasets for Sri Lanka for the period, 1997–2018, we show that the agricultural sector is the most affected by climate induced disasters, although not all agricultural sub-sectors are equally vulnerable. Similarly, the industrial sector is shown to suffer a significant negative impact due to strong winds and landslide events. The textiles and garment sub-sectors are negatively impacted while the machinery sub sector shows a positive impact. This indicates the effect of higher demand for new machinery and equipment employed in disaster reconstruction efforts. The study further reveals that the services sector derives a mostly positive impact following disasters, especially public administration and health subsectors. The study also indicates that for Sri Lanka during the current decade, there has been a considerably greater negative impact from climate induced disasters compared to the previous decade.

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Performance evaluation of cement mortar produced with manufactured sand and offshore sand as alternatives for river sand

Construction and Building Materials, Vol 297, Art No. 123784

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Abstract

This study investigates the fresh and hardened state properties of cement-sand mortar comprising manufactured sand and offshore sand as alternatives for a complete replacement of river sand. Two types of manufactured sand were selected based on different rock types such as Hornblende-Gneiss and Charnockite. Offshore sand was collected from an open stock pile after required period of washing. Mortars were manufactured with a binder of Portland Limestone Cement. Binder-to-aggregate ratios of 1:3, 1:4 and 1:6 were considered in this study and manufactured sand was replaced at 0%, 25%, 50%and 75% with offshore sand. To check the influence of sand alternatives and blending ratios, fresh and hardened state properties of alternative mortars were analyzed and compared with reference mortars which were made with river sand alone. Wet and dry bulk densities of mortars were increased with lower replacement levels with offshore sand. Most mortars with blended sand improved the workability while consistency and initial setting time of mortars were not significantly affected. Inflated bleeding of mortars was noticed with the alternatives and replacement levels. Workable life was decreased at small replacements. When manufactured sand in mortar content was 25% and 50%, the water retentivity was significantly improved than other replacements and control mixes. Mortars at lower replacements greatly advanced the flexural strength, compressive strength and capillary water absorption. Linear shrinkage and thermal expansion of mortars were also affected with the selected replacement levels. Based on the overall performance of mortars, blended sand at 25% replacement of manufactured sand with offshore sand was deduced as the feasible solution for completely replacing river sand and to produce economical mortars.

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Investigation of the engineering properties of cementless stabilized earth blocks with alkali-activated eggshell and rice husk ash as a binder

Construction and Building Materials, Vol 277, Art No. 122371

K. Poorveekan, K.M.S. Ath, A. Anburuvel, N. Sathiparan

Abstract

Employing appropriate waste materials in place of cement is the possible practical solution that addresses the issues of construction material scarcity and the environmental concerns pertained to the industry as a whole. This method also helps to dispose of a considerable amount of waste in a sustainable way. The usage of waste materials is economically beneficial. The present study was conducted to develop geopolymer technology to produce stabilized earth blocks using rice husk ash, eggshell powder and caustic soda. Different combinations of the mixture were taken into consideration to determine the optimum mix proportions of the constituents. In the present study, experimental research has been carried out including variations of the binder content (10%, 15% and 20%), the eggshell powder to rice husk ash ratio (10:90, 20:80, 30:70 and 40:60) and the calcination of the eggshell powder (raw and calcination at 700 ^{o}C). A total of 288 cubes sized 50 * 50 * 50 mm^3 and 36 beams at a size of 40 * 40 *160 mm^3 were cast and tested after a curing period of 7, 14 and 28 days, respectively. The analysis of the density, moisture absorption, compressive strength, flexural tensile strength, impact strength, production cost, energy requirement and CO_2 emissions during production showed that the 10:90 and 20:80 eggshell powder to rice husk ash binder are suitable for block production. The results show that the optimal combinations of geopolymer blocks achieved the strength limits recommended by the Sri Lankan standard for non-load bearing masonry units, even though the compressive strengths of the geopolymer blocks were comparatively less than that of the conventional cement stabilized earth blocks. The study results also indicate that the cost, energy requirements and CO_2 emissions during block production can be reduced considerably using geopolymer technology.

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Performance of masonry columns confined with composites under axial compression: A state-of-the-art review

Construction and Building Materials, Vol 274, Art No. 121791

Julian Thamboo

Abstract

The confinement technique has been effectively used to enhance the strength and ductility of structural elements. Since masonry possesses relatively limited ductility and tensile strength, the confinement has been shown to improve the performance of masonry elements, particularly the columns. Primarily three different techniques are implemented to confine the masonry columns (1) fibre reinforced polymer (FRP) wrapping (2) fabric reinforced cementitious matrix (FRCM) application and (3) confinement of mortar joints by steel grinds or wire hooping. Although the above-mentioned techniques have shown to provide confinement and improve the performance of masonry columns, each has its own advantages and disadvantages in terms of applicability, compatibility, strength enhancement, ductility gain and reversibility. Therefore, in this paper, an attempt has been made to critically review the performance of masonry columns confined with above mentioned techniques to appraise their performances in relation to various parameters. For these purposes, three sets of experimental databases have been developed for the above stated techniques from the past research studies. Further several analytical models have been independently developed to predict the confined compressive strength and axial stress–strain behaviour of the masonry columns; subsequently the predictabilities of those analytical models were verified by comparing against with the experimental database. The analyses revealed, that the analytical models given in the Italian guidelines CNR DT 200/215 conservatively predict the confined strength of masonry columns. Therefore, it can be recommended to use deliberately across different confinement techniques investigated.

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Utilization prospects of eggshell powder in sustainable construction material – A review

Construction and Building Materials, Vol 293, Art No. 123465

Navaratnarajah Sathiparan

Abstract

With the rapid growth of infrastructure development, the demand for construction materials has also increased. Cement is one of the materials used widely around the world. Using nonrenewable resources in the production of cement and the CO_2 emissions has created significant environmental issues. Using waste materials as a partial or full replacement for cement is one of the practical solutions available. The conversion of waste materials into a cement replacement may reduce the environmental issues caused by the open dumping of the waste. Eggshell is a waste material that can be obtained from restaurants, bakeries and households. If effective uses for eggshell can be found, it would create an opportunity for a sustainable solution. This paper presents the latest studies on the use of eggshell powder in construction materials such as concrete, cement mortar, brick, alkali-activated binder and a soil stabilizer. The physical and chemical properties of the eggshell powder and the factors that influence the characteristics of eggshell power were also analyzed. The results indicate that the characteristics of cementitious materials improved. Specifically, a 10–15% cement replacement with eggshell powder results in strength development comparable to the control. Several studies have shown the potential of using eggshell powder as a stabilizer for soil and brick to improve its mechanical properties. Eggshell powder is therefore energy and cost-effective solution to the problem of sustainable construction materials.

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Improved design provisions for reinforced concrete block masonry walls under axial compression

Construction and Building Materials, Vol 310, Art No. 125226

Julian Thamboo, Tatheer Zahra, Mohammad Asad, Mengli Song

Abstract

The provisions pertaining to design of reinforced masonry (RM) walls under axial compression in the Australian masonry standard AS 3700 (2018 version) have been revised based on the recent findings that the lateral restraining ties do not significantly affect the performance under axial compression. The other design codes such as Canadian (CSA S304.1-14), American (MJSC) and previous version of Australian (AS 3700-2011) standards consider the RM walls as unreinforced masonry (URM) under axial compression, if they are not restrained with lateral ties in both directions. However, it is widely believed that these provisions are stringent and over- conservative, as proven by the experimental studies that the compression bars in RM are effectively restrained by the surrounding well compacted grout. Hitherto, no systematic studies have been carried out to determine the applicability of these provisions to the reliability of the compression design approaches of RM walls. Therefore, in this research an attempt has been made to evaluate the accuracy and reliability of the design provisions outlined in the selected design standards (AS 3700, CSA S304.1-14 and MSJC). The experimental database generated in the authors' previous study was used to verify the reliability of the design provisions. The reliabilities of the design expressions were verified using the first-order reliability method (FORM). The reliability analyses revealed that the provisions specified in the standards are quite conservative as they have exceeded the target reliability index of 3.6 for the analysed RM walls. The current provisions of AS 3700 (2018 version) have shown to predict the axial capacities of the walls better than other standards, while satisfying the target reliability limit. Thus, it can be stated that revisions made in AS 3700 (2018 version) are effective and economical for designing the RM walls as they have eased the requirement of lateral restrainers and account for a realistic contribution of grout and compression steel strengths in determining the axial capacity.

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Experimental investigation on the effectiveness of lateral restrainers to the vertical steel in reinforced masonry walls under axial compression

Construction and Building Materials, Vol 297, Art No. 123790

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Abstract
Reinforced masonry (RM) walls are mostly used in low to mid rise residential/industrial buildings in cyclonic and seismic regions. They are conventionally constructed with grout embedded vertical steel reinforcements positioned in the middle of the hollow blocks. However, these reinforcing bars are rarely detailed with lateral restrainers, which are considered essential in the design standards to avoid buckling of the vertical bars. This research investigates the effectiveness of lateral restrainers to the axial compression resistance of RM by testing of 128 walls under concentric and eccentric compression with different reinforcement configurations. The tested walls (190 mm thick * 600 mm wide) consisted of various types of detailing with and without lateral restrainers, grout strengths (25–50 MPa), and three heights (800 mm, 1400 mm and 2400 mm). Two walls were constructed and tested for each configuration, out of which one was tested to determine the ultimate strength and the other tested to acquire ultimate strength, axial deformation of the wall, axial strain in the steel bars and strain on the surfaces of the face-shell. The experimental results revealed that the grout has significantly contributed to the axial capacity, whilst the lateral restrainer reinforcement detailing had no significant effect on either the steel strain development or on the overall strength of the RM walls. Under concentric compression, the strain measurements in the vertical steel bars indicated that irrespective of the absence or presence of the lateral restrainers, the vertical bars remained under compression throughout the loading history with no evidence of buckling. Effects of slenderness and eccentricity were also evaluated for the RM walls under compression. It can be concluded from this research that the RM walls designed and constructed without lateral restrainers to resist cyclonic and seismic forces need not be treated as unreinforced masonry (URM) for compression if the vertical bars are surrounded by well compacted grout.

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Thermal and environmental impact analysis of rice husk ash-based mortar as insulating wall plaster

Construction and Building Materials, Vol 283, Art No. 122744

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Abstract

The energy used to maintain the thermal comfort of buildings significantly contributes to the GHG emissions and global warming. In this study, a sustainable and cost-effective rice husk ash (RHA)-based mortar for wall plastering has been developed to provide better thermal insulation, reduce the operational energy and enhance the thermal comfort. Consequently, RHA was partially replaced with the sand in the conventional mortar to produce the RHA-based plaster. Initially, compressive strengths and thermal conductivities of the selected mortar mixes were assessed. The results highlight that the RHA can be replaced up to 30% instead of sand in mortar to produce the thermally enhanced wall plaster. Further, two identical prototype model houses were constructed with RHA-based (i.e. 30% of RHA) and conventional plasters to evaluate their heat transfer, heat flux, and the characteristics of internal and external wall surface temperatures in open weather conditions. It was noted that the average peak heat flux reduction formed by the RHA-based plaster was 10%. The average daily heat transfer reduction across the wall with RHA-based plaster was about 26%. Results also show that RHA-based plaster can reduce the energy that required to maintain thermal comfort by about 9% than the conventional plaster. Moreover, the environmental impact analysis was also conducted to assess the sustainability performance of RHA-based mortars. The environmental impact assessment revealed that the RHA-based plaster has less environmental impact than the conventional mortar. Furthermore, the CO_2 emission generated by the production of RHA-based mortar is about 14% less than the conventional plaster.

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Behaviour of concrete specimens retrofitted with bio-based polyurethane coatings under dynamic loads

Construction and Building Materials, Vol 270, Art No. 121860

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Abstract

Experimental investigation was conducted using concrete specimens to assess the effectiveness of bio-based polyurethane (PU) coating synthesized from palm kernel oil in enhancing the dynamic mechanical response of concrete specimens under quasi-static and dynamic loads. The dynamic loading condition was simulated by conducting three-point bending tests at a strain rate of 0.067 s^{-1}, and simultaneously, under quasi-static loading (strain rate of 0.00033 s^{-1}) conditions. The application of PU layer(s) (either on the impact face, rear face, or on both faces of the concrete specimens) increases the dynamic resistance of the concrete element, which can be enhanced by increasing coating thickness on either face of the concrete element. Under dynamic conditions, with 10% of total coating thickness compared to the beam depth, strain during ultimate failure, and strain energy density were enhanced significantly with marginal enhancement in the ultimate flexural strength. PU coating does not debond during ultimate failure of the test specimens which implies good adhesion characteristics, and even with minimum coating thickness (2.5%), drastic fragmentation effects can be reduced. Bio-based PU is a green material and application of PU coating provides a viable and sustainable technique for protecting concrete structures against dynamic loads.

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Effect of waste rice husk ash from rice husk fuelled brick kilns on strength, durability and thermal performances of mortar

Construction and Building Materials, Vol 268, Art No. 121794

G.H.M.J. Subashi De Silva, S. Vishvalingam, T. Etampawala

Abstract

Effect of waste RHA, residual ash generated from rice husk fuelled brick kilns, on strength, durability and thermal performances of mortar was investigated. Cement in the mortar was replaced by 0%, 5%, 10%, and 20% of waste RHA. Compressive strength, bulk density, water absorption, porosity, sorption rate, sulfate, acid and alkaline resistance, thermal performance, and microstructural analysis of specimens were examined.

Bulk density of control (i.e. 0%) and 20% waste RHA mortar were 2033 kg/m^3 and 1821 kg/m^3, respectively, promising a lightweight mortar by blending waste RHA into the mixture. At 56 days, Strength activity index (SAI) was achieved to be 95% and 85% for 5% and 10% waste RHA mortar, respectively, indicating better compressive strength achievement with waste RHA added mortar. The expansion due to sulfate exposure was reduced by 54% and 70%, for 5% and 10% waste RHA mortar, respectively. Weight loss due to acid exposure was reduced by 45%, 40%, and 25% for 5%, 10%, and 20% waste RHA specimens, respectively. The weight loss due to alkaline exposures was reduced from 3.13% to 2.41% with rising waste RHA level from 0% to 5%. Mortar with 20% waste RHA had a higher temperature difference than the control mortar, indicating that RHA contributed to the reduced thermal conductivity. At 5% waste RHA sample, high counts of CSH was formed, micro-voids were filled, making it a dense structure, which is favorable to achieve improved strength and durability performances.

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