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DNR

Impacts of climate change on the fate of contaminants through extreme weather events

Shiv Bolan, Lokesh P. Padhye, Tahereh Jasemizad, Muthusamy Govarthanan, N. Karmegam, Hasintha Wijesekara, Dhulmy Amarasiri, Deyi Hou, Pingfan Zhou, Basanta Kumar Biswal, Rajasekhar Balasubramanian, Hailong Wang, Kadambot H.M. Siddique, Jörg Rinklebe, M.B. Kirkham, Nanthi Bolan

Abstract

The direct impacts of climate change involve a multitude of phenomena, including rising sea levels, intensified severe weather events such as droughts and flooding, increased temperatures leading to wildfires, and unpredictable fluctuations in rainfall. This comprehensive review intends to examine firstly the probable consequences of climate change on extreme weather events such as drought, flood and wildfire. This review subsequently examines the release and transformation of contaminants in terrestrial, aquatic, and atmospheric environments in response to extreme weather events driven by climate change. While drought and flood influence the dynamics of inorganic and organic contaminants in terrestrial and aquatic environments, thereby influencing their mobility and transport, wildfire results in the release and spread of organic contaminants in the atmosphere. There is a nascent awareness of climate change's influence of climate change-induced extreme weather events on the dynamics of environmental contaminants in the scientific community and decision-making processes. The remediation industry, in particular, lags behind in adopting adaptive measures for managing contaminated environments affected by climate change-induced extreme weather events. However, recognizing the need for assessment measures represents a pivotal first step towards fostering more adaptive practices in the management of contaminated environments. We highlight the urgency of collaboration between environmental chemists and climate change experts, emphasizing the importance of jointly assessing the fate of contaminants and rigorous action to augment risk assessment and remediation strategies to safeguard the health of our environment.

About the Journal

Science of The Total Environment

Impact Factor – 9.8

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Interactions and transport of hexavalent chromium with microplastics in detergent-dissolved water

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Abstract

The ubiquitous co-existence of microplastics and hexavalent chromium (Cr^{6+}) causes their interactions, which are heavily influenced by the composition of wastewater. However, microplastic−bound vector transportation of Cr^{6+} in the presence of different species in water remains poorly understood. To address this paucity, Cr^{6+} adsorption onto pristine and aged polyethylene (PE) microplastics with four different sorption media was accessed to understand their influence. Thus, the sorption behavior of PE microplastics at different solution pHs (3–10), contact time (for 7 days), and concentration of Cr^{6+} (1−30 mg L^{-1}) was tested. The effect of ionic species (0.1 M of $NaNO_3$), dissolved organic matter (1.5 mg L^{-1} of humic acid (HA), and detergent-dissolved water (4% v/v) on Cr^{6+} adsorption was also examined. The highest adsorption capacities of Cr^{6+} (0.62−1.00 and 0.31−0.60 mg g^{-1} for detergent and $NaNO_3$-dissolved water, respectively) showed at the pH range of 2.0–3.0 except for HA-dissolved water. Detergent-dissolved water demonstrated remarkable adsorption than ultrapure water, $NaNO_3$ and HA-dissolved water. Hydrophobic and electrostatic interactions governed the surface complexation of Cr^{6+} on PE microplastics in detergent-dissolved water. Pseudo-second-order kinetic model best-fitted for pristine microplastics indicating the chemisorption of Cr^{6+}. Best fitting with fractional power and intra-particle-diffusion kinetic models with aged microplastics indicated a diffusion-controlled physisorption. Isotherm data modeling demonstrated non-linear corporative adsorption behavior compiled with Hill model for both microplastics. This study deduced that detergent mixing could boost the vector transport ability of PE microplastics for Cr^{6+} migration in aquatic environments.

About the Journal

Physics and Chemistry of the Earth, Parts A/B/C

Impact Factor – 3.7

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DPST

Effect of TiO_2 nano fillers on ionic conductivity enhancement in $Mg(BH_4)_2$:polyethylene oxide (PEO) polymer gel electrolyte

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Abstract

Temperature dependence of ionic conductivity of three different compositions of the $Mg(BH_4)_2$:polyethylene oxide (PEO):propylene carbonate (PC) polymer gel electrolyte with $Mg(BH_4)_2$:PEO molar ratios of 1:8, 1:10, and 1:12 was studied. The composition with $Mg(BH_4)_2$:PEO = 1:10 exhibited the highest ionic conductivity of 7.60×10^{-6} S cm^{-1} at 30 °C. The effect of TiO_2 nanofiller on ionic conductivity enhancement was studied for $Mg(BH_4)_2$:PEO:PC:TiO_2 polymer gel electrolyte by varying the TiO_2 weight ratio from 0 to 12.5 wt.%. The highest ionic conductivity of 17.95×10^{-6} S cm^{-1} at 30 °C was exhibited by the electrolyte composition with 10 wt% of TiO_2 nanofiller. The optimized electrolytes had a Mg^{++} cationic transference number of 0.22 for the filler free electrolyte and 0.30 for the TiO_2 10wt% filler incorporated electrolyte. Both electrolytes had negligible electronic conductivity. A more than two-fold increase in the ionic conductivity and a 30% increase in Mg^{++} ion transference number can be attributed to the nanofiller effect caused by TiO_2. This preliminary study shows the possibility of developing this PEO-based polymer gel electrolyte to be used in rechargeable Mg ion batteries.

About the Journal

Journal of Solid State Electrochemistry

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Book Chapters

DNR

Overview of Sri Lankan Fungi and Lichen Research

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Abstract

Sri Lanka, with a humid tropical climate, is a potentially fungus-rich country. It has been estimated to have 33,000 species of fungi, but little more than 2000 of these have been documented. Compared to limited number studies of microfungi, more research has been directed toward lichens and macrofungi by mycologists in Sri Lanka. Some studies have been carried out on the taxonomy of microfungi, but based on estimates of the size of this group for other regions of the world, many more microfungi remain to be discovered. Very few edible mushrooms are consumed by people in Sri Lanka mainly due to the lack of knowledge, while commercial mushroom cultivation is also limited to a very few examples. This chapter addresses the current status of macrofungi, microfungi (including fungus-like organisms), and lichenological studies in Sri Lanka.

About the Book

Biodiversity Hotspot of the Western Ghats and Sri Lanka

Publisher: Apple Academic Press

E-Book ISBN: 9781003408758

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Physiography, Climate, and Historical Biogeography of Sri Lanka in Making a Biodiversity Hotspot

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ABSTRACT

The island of Sri Lanka, located immediately southeast of the Indian mainland, shares the continental shelf of the India-Sri Lanka (Deccan) plate. The recognition of Sri Lanka and southern India as a globally unique biogeographic entity goes back to Alfred Russel Wallace, who identified the Ceylonese subregion of Oriental region in global zoogeography, which with much refinement of the boundary to include only moist forests have given rise to the Western Ghats and Sri Lanka biodiversity hotspot, a global conservation priority today. This delimitation recognizes the concentration of endemic assemblages of flora and fauna, currently under the threat of being lost owing directly to human impacts. Being a continental island with lesser degree of isolation compared with an oceanic one, together with its topographic and climatic heterogeneity and the eventful geological history, Sri Lanka has assembled a unique biota with an exceptionally high diversity and endemicity for its size, unlike isolated oceanic islands which usually possess highly endemic biotas depauperate in diversity. Sri Lanka experienced species colonization events from the mainland after its separation from India ~50 Ma, initially during the Oligocene followed by dispersal events in the late Miocene, Pliocene, and Pleistocene epochs during glacial periods with lowered sea level (at least five times over the last 500,000 years), followed by isolation-driven speciation during interglacial periods. The northward drifting of the Deccan plate starting deep from global south to the northern hemisphere just above the equator over the last 200 million years have given it so many different elements of biota, which took refuge in Sri Lanka especially during the volcanism of Deccan traps. Remarkable combination of climatic and topographic isolation mechanisms within the island have resulted in insular speciation making endemism values as high as 98% in freshwater crabs and 89% in land snails and amphibians. The remaining fragmented natural habitat patches of the island hence serve as only places for those species to strive on Earth, making this crucible of speciation in southwestern jungles of Sri Lanka a stronghold for biodiversity conservation amidst the challenges placed by the climate change.

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DNR

Diversity, Distribution, and Biogeography of Sri Lankan Birds

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Abstract

The Western Ghats and Sri Lanka biodiversity hotspot is well established, for which Sri Lanka contributes a relatively small land area (65,610 km²), exceptionally rich in biodiversity and endemism packed in a continental island. The tropical climates, varied rainfall dominated by two monsoons, topographical heterogeneity, and geological history have shaped this biological diversity. Currently, Sri Lanka is home to 479 bird species with 34 country endemics. These bird species belong to 19 orders and 89 families. Among them, 244 (51%) species are breeding residents, 147 (31%) are migratory species, and 88 (18%) are vagrant species. Recent molecular phylogenetic studies have revealed the possibility of adding a few more endemic bird species to Sri Lanka, yet to be further explored. The 66 subspecies endemic to the country provide the guideline to direct future molecular studies with an integrated approach to establishing their taxonomic status. The island can be regionalized to seven well-defined avifaunal zones following the biogeography of resident birds with unique species assemblages in each zone. However, most of the birds are facing elevated levels of threat due to habitat loss, habitat degradation, habitat fragmentation, human-induced land use changes, unplanned development of linear structures, and climate change. To mitigate those threats, Sri Lanka has declared approximately 30% of its land area under varied protected area jurisdictions; identified 70 important bird areas; initiated habitat restoration projects; conducted awareness creation targeting the general public toward biodiversity conservation and sustainability. The need for well-planned monitoring programs on bird population fluctuations; conducting explicit scientific studies, especially on the endemic species; establishment of sound collaboration between government depart- ments, NGOs, and other stockholders, including the private sector, is essential to ensure the long-term conservation of Sri Lankan birds for the future.

About the Book

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Conference Proceedings

DNR

Lichen biomonitoring studies as eco-sustainable tool

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Abstract

Lichens have evolved due to a symbiotic relationship between a dominant fungus and one or more photosynthetic partners including algae or cyanobacteria. In addition, some lichens are associated with basidiomycete yeasts and diatoms. The unusual biology of the lichen symbiosis makes them particularly sensitive to habitat disturbances or climatic change due to natural and anthropogenic activities and also sensitive to environmental disturbances such as air pollution, heavy metal pollution, radionuclide deposition, microplastic depositions, and acid rains. Further, they show morphological and physiological changes due to stress caused by contaminants and therefore act as good early alarm systems in the environment. Lichens lack defensive tissues, so they can easily absorb water, nutrients, and gasses straight from the environment. Further, accumulative biomonitors can store contaminants in their tissues and are used for the measurement of the concentration of such contaminants in the environment. In addition, lichen species are more common in any habitat, and easily sampled, and low-cost methods are applicable for sampling and analysis. Because of such reasons, lichens have been used as a biological indicator for many studies for more than twenty decades. Biomonitoring studies using lichens as the biological indicators have increased and widened in terms of various parameters, monitoring techniques, and sampling areas during the last fifty years. Many techniques and discoveries for lichen biomonitoring were found by researchers recently and all these discoveries indicate abundant new opportunities for new research to explore in terms of biomonitoring using lichen as the biological indicator for many aspects. Due to many applicable advantages in many fields, lichen biomonitoring can be used as an eco-sustainable tool for air quality management in urban, semi-urban, and areas in very remote and places hardly available for instrumental measurements. Further, the Lichen bio- monitoring approach may help to make the sustainable balance between economic growth and ecological sustainability confirming a clean environment, and thus the aesthetic, and health security of the world.

About the Conference

International Conference on Microbial Bioprospecting towards Sustainable Development Goals

24 – 25 November 2023

India

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