PROCEEDINGS

INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH

2025

CHALLENGES AHEAD

History Culture Ecosystems Biodiversity Sustainability Livelihood Services Leisure Future

All begins with water

Postgraduate Institute of Science (PGIS) University of Peradeniya - Sri Lanka

21st & 22nd November 2025

Organized by the

BOARD OF STUDY IN ENVIRONMENTAL SCIENCE
POSTGRADUATE INSTITUTE OF SCIENCE (PGIS)
UNIVERSITY OF PERADENIYA, SRI LANKA

PROCEEDINGS

10th International Symposium on
WATER QUALITY AND HUMAN HEALTH: CHALLENGES AHEAD
November 21–22, 2025

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Organized by the

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POSTGRADUATE INSTITUTE OF SCIENCE (PGIS)
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Postgraduate Institute of Science (PGIS)
University of Peradeniya, Sri Lanka

It is with great pleasure that I extend my warm greetings to all participants of the "International Symposium on Water Quality and Human Health: Challenges Ahead". This event reflects the Postgraduate Institute of Science's continued commitment to fostering interdisciplinary research and scientific dialogue on issues that are critical to Sri Lanka and the wider global community. Safeguarding water resources and protecting human health remain among the most urgent challenges of our time.

Sri Lanka's inland water systems contribute significantly to the nation's economy and well-being by supporting irrigation, hydropower generation, inland fisheries, biodiversity, and the supply of drinking water. However, these essential resources are increasingly threatened by pollution, climate variability, industrial effluents, agricultural runoff, land-use changes, and other anthropogenic pressures. Ensuring their long-term quality and sustainability is therefore a national priority requiring coordinated scientific and policy-driven action.

This symposium aims to facilitate analytical, evidence-based, and solution-oriented discussions on the interactions between water quality, environmental processes, and human health. I am encouraged by the diverse participation of academics, scientists, engineers, medical professionals, policymakers, NGO representatives, and environmental managers. Such a multidisciplinary platform is essential for shaping comprehensive and practical responses to complex water-quality issues.

The technical sessions will address a broad range of themes, including physicochemical and biological characteristics of freshwater systems, pollution sources and associated health risks, community-level impacts of declining water quality, sustainable management approaches, and global perspectives on water governance. A special focus on the Chronic Kidney Disease of Unknown Etiology (CKDu) in the North-Central Province will provide an opportunity to share new findings and strengthen collaborative efforts.

I wish to express my sincere appreciation to Prof. Sudharma Yatigammana, Dr. Sasitha Abeyweera, the Editorial and Organizing Committees, reviewers, and all presenters for their dedication in organizing this important event.

I wish all participants a successful, insightful, and impactful symposium.

Prof. N. W. B. Balasooriya
Director
Postgraduate Institute of Science (PGIS)
University of Peradeniya

Message from the Chairperson
Board of Study in Environmental Science
Postgraduate Institute of Science (PGIS)

I am pleased to deliver a message to mark the Symposium on "Water Quality and Human Health: Challenges Ahead", organized by the Board of Study in Environmental Science of the Postgraduate Institute of Science (PGIS), University of Peradeniya, for the 10th time, enabling sharing the knowledge on water quality, aquatic biology, water pollution and human health, and water treatment, all of which are persistent national and international issues.

Although water quality has been a long-term topic being discussed and researched upon, emerging water pollutants, substances not previously regulated but of growing concern, including pharmaceuticals, personal care products such as cosmetics and sunscreens, microplastics and nanoplastics, and per- and polyfluoroalkyl substances (PFAS), are often found in wastewater, agricultural runoff, and industrial discharge. These water pollutants not only lead to the deterioration of ecosystem health, but also make it difficult to remove them by existing water treatment processes. Moreover, emerging pollutants lead to emerging diseases and health issues, such as cancers, organ damage, neurological damage, and reproductive and endocrine disorders. Health impacts of pharmaceuticals, personal care products, and PFAS are new concerns, which are still under investigation.

Consequently, novel research is needed in determining water quality, water treatment, and related health issues. In this respect, the Board of Study in Environmental Science of the Postgraduate Institute of Science has taken the lead in continuing this Symposium as an annual event with novel findings disseminated each time. We all have the responsibility of preserving the quality of water for the generations to come. Let's consider this as a collective responsibility. If humans protect the environment, the environment will protect humans!

Namal Priyantha
B.Sc. (Perad.), Ph.D. (Hawaii), FNASSL, FIChemC, CChem

Chairman, Board of Study in Environmental Science, PGIS
Senior Professor in Chemistry, University of Peradeniya

Message from the Symposium Chairperson

It is with great pleasure that I extend my warmest welcome to the 10th International Symposium on Water Quality and Human Health: Challenges Ahead, organized by the Board of Study in Environmental Science, Postgraduate Institute of Science (PGIS), University of Peradeniya. Through the PGIS, we have been organizing events related to water and water science to share and disseminate knowledge, especially with the younger generation who are highly enthusiastic to ensure the quality of water to safeguard human health. However, under this theme, we are having this symposium for the 10th time, making this event a landmark of the PGIS, University of Peradeniya. Our aim is now to establish the symposium nationally and internationally recognized event and get it into the indexed conference list of the subject. Thus, it will provide a healthy atmosphere for intellectual exchange of thoughts and sharing of research findings among colleagues, researchers, policy makers, and students throughout the world.

The past symposia, as well as the current one, followed a strict rule of guidelines of a blind-review process and were then seconded by an experienced editorial board to update the abstracts based on reviewers' comments and to conform to the template guidelines.

As the chairperson of the organizing committee of the symposium, I would like to express my sincere gratitude to all the members of the organizing committee and to everyone who worked tirelessly to make this event a reality and a success. Further, I would like to express my deepest gratitude to the distinguished keynote speaker, Prof. Masamoto Tafu of the National Institute of Technology, Toyama College, Toyama, Japan, and the plenary speakers for accepting our invitation to share their knowledge with us today. Further, I am grateful to the reviewers for their support in making the abstracts more effective.

I hope that the International Symposium on Water Quality and Human Health: Challenges Ahead 2025 will be a rewarding opportunity for knowledge sharing for those who work in the field with the aim of finding solutions to current water problems that exist in the world today.

Thank you.

Prof. Sudharma Yatigammana
Department of Zoology
University of Peradeniya

Message from the Editor-in-Chief

It is with great pleasure that I welcome you to the proceedings of the 10th International Symposium on Water Quality and Human Health, held at the Postgraduate Institute of Science, University of Peradeniya, Sri Lanka, on the 21st and 22nd of November 2025.

Water is fundamental to life, health, and sustainable development. Its quality directly influences ecosystems, public health, and socio-economic resilience. In an era marked by increasing environmental challenges and growing demand for safe water, the need for rigorous scientific inquiry and collaborative solutions has never been more urgent.

This symposium brings together researchers, practitioners, and policymakers to share insights, innovations, and evidence-based approaches to safeguarding water quality and promoting human well-being. We are pleased to report that the symposium received 47 abstracts from contributors across diverse disciplines and regions. After a thorough peer-review process, 44 abstracts were accepted for presentation, reflecting the high caliber and relevance of the submissions.

I extend my sincere appreciation to all authors, reviewers, editors, and organizing committee members for their dedication and scholarly contributions. May these proceedings serve not only as a record of the symposium but also as a catalyst for future research, dialogue, and action in the vital domain of water and health.

Warm regards,

Dr. Chaminda Wijesundara
Editor-in-Chief

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Keynote Address

DEVELOPMENT OF ECO-FUNCTIONS OF DICALCIUM PHOSPHATES (DCPs) FOR ENVIRONMENTAL APPLICATIONS

Masamoto Tafu
National Institute of Technology (KOSEN), Toyama College, Toyama City, Japan

Dicalcium phosphates (DCPs, $CaHPO_4 \cdot nH_2O$) are widely utilized as calcium phosphate compounds in fertilizers, animal feeds, and as precursors for various calcium phosphate products. In this study, we report recent advancements in the development of novel environmental functionalities of DCPs. Dicalcium phosphate dihydrate (DCPD, $CaHPO_4 \cdot 2H_2O$) was found to react with fluoride ions in aqueous media, forming stable fluorapatite (FAp, $Ca_{10}(PO_4)_6F_2$). Detailed investigations revealed that the reaction mechanism involves the formation of nanoscale precursor particles on the surface of DCPD, generated immediately upon hydration. This reaction pathway not only enables immobilization of fluoride ions in contaminated water but also facilitates the incorporation of various divalent cations into the calcium sites of the FAp crystal lattice. For example, strontium-substituted fluorapatite (Sr-FAp) was successfully synthesized by reacting DCPD with aqueous fluoride ions in the presence of strontium. Notably, Sr-FAp did not form in the absence of fluoride ions, indicating the essential role of fluoride in the substitution process. Hydroxyapatite (HAp, $Ca_{10}(PO_4)_6(OH)_2$), a structural analogue of FAp, is known for its capacity to adsorb various gaseous compounds, including ammonia. Building on this concept, we explored the ammonia adsorption behavior of DCPs to assess their potential for novel agricultural applications. Although ammonia serves as an essential nitrogen source for crops, its emission from composting processes contributes to odor pollution and corrosion of metal infrastructures.

We hypothesized that DCPs could adsorb ammonia at composting sites, thereby transforming into a multifunctional fertilizer containing both nitrogen and phosphate. DCPD samples derived from gelatin production using bovine bone as a byproduct were compared with reagent-grade DCPs. Additionally, dicalcium phosphate anhydrous (DCPA, $CaHPO_4$) was prepared by thermal treatment of DCPD at 190 °C for 72 hours. The crystalline structures and particle morphology of DCPD and DCPA were characterized using powder X-ray diffraction (XRD) and scanning electron microscopy (SEM). Ammonia adsorption experiments were conducted by exposing DCP particles to nitrogen gas containing 10 ppm of ammonia. Adsorption capacity was evaluated based on specific surface area measurements obtained via BET nitrogen adsorption analysis. The results revealed significant differences in adsorption behavior between reagent-grade and byproduct-derived DCPD and DCPA. XRD analysis revealed pronounced crystal orientation along the (020) plane in reagent-grade DCPD, suggesting that crystal orientation may influence ammonia adsorption performance.

Plenary Speech

THE RIPPLE EFFECT: CLIMATE CHANGE, WATER QUALITY, AND THE FUTURE OF HUMAN HEALTH

Udaya Ralapanawa

Professor in Medicine, Department of Medicine, University of Peradeniya

Climate change has emerged as one of the most significant drivers altering global water resources, which ultimately define the future course of human health. This topic describes how climate change fuels a ripple effect chain reaction, resulting in severe repercussions to human health. As a consequence of rising global warming, there is increased aridity, higher rates of evaporation, unpredictable rainfall patterns, and higher inland flooding due to increased sea levels. Each of these factors independently affects water availability and quality. Contamination types include microbial contamination during floods, chemical contamination during arid conditions, and saltwater intrusion into freshwater resources in low-lying areas. This creates a backdrop menacing enough to cause severe repercussions for human health.

These disruptions result in extreme fluctuations in global epidemiology. Flooded and stagnant water increases the risk of waterborne illnesses like cholera and diarrheal diseases. Additionally, rainy conditions increase the habitable zones of mosquitoes, leading to the spread of malaria and dengue fever to higher elevations and latitudes. Chronic illnesses result from arsenic-contaminated groundwater, which cause skin conditions like arsenical dermatitis, cancers, and renal failure. Heat stress and consequent dehydration, previously limited to agricultural zones, result in a growing outbreak of renal injuries among agricultural workers.

Sri Lanka is extremely sensitive due to its mono-rain-dependent water sources, widespread utilization and availability of surface and groundwater resources, and the heavily agriculturalized Dry Zone. The increased warming, protracted drought, and consequent lowering of groundwater resources make it extremely insecure water-wise. As water resources diminish, naturally occurring toxins like high concentrations of fluoride and mineral “hardness’’ escalate to dangerously high quantities. At this critical level, artificial toxins like nitrates, cadmium, pesticides, and industrial wastes continue to degrade sources usable for human consumption. This culminates in one of Sri Lanka’s biggest crises concerning human health: Chronic Kidney Disease of unknown etiology (CKDu). CKDu is currently estimated to affect over 100,000 individuals, almost exclusively males, within the Dry Zone. This condition is strongly associated with high-fluoride, hard groundwater sources, exposure to metals suspected to be linked to agrochemical-related, and exposure to high heat. There are water safety planning, climate-smart irrigation, disease surveillance, and One Health/Planetary Health approaches that can serve to build resilience. The take-home message is very simple: protecting human health is about safeguarding the climate and water.

Plenary Speech

UNVEILING THE HIDDEN DYNAMICS OF NONTUBERCULOUS MYCOBACTERIA IN WATER ENVIRONMENTS

Fumito Maruyama

The IDEC Institute, Hiroshima University, Higashi-Hiroshima, Japan

Nontuberculous mycobacteria (NTM) are opportunistic environmental pathogens that can cause lymphatic, pulmonary, and skin infections via exposure through ingestion or inhalation. These infections predominantly affect older individuals (over 90% of patients are elderly women) and, unlike tuberculosis, are not transmitted person-to-person. NTM are known to colonize drinking water systems, including distribution pipelines and household plumbing, forming biofilms that can persist even after chlorination. However, the factors governing their proliferation in these built environments remain poorly understood, and their presence in water supplies has raised significant public health concerns.

We investigated the occurrence and ecology of NTM in water environments and their implications for water quality. Our study combined field sampling from municipal drinking water supplies and in-home water sources with advanced microbiological analyses (16S rRNA gene amplicon sequencing and culture) to characterize NTM prevalence. We also examined how water treatment and handling practices influence NTM survival.

Surveys in Hiroshima, Japan, revealed that NTM are frequently present in domestic water systems. In a three-year survey of 71 households, we detected NTM in a high proportion of tap water samples, with especially high detection rates in single-family homes. Multiple NTM species were identified, among which *Mycobacterium avium* and *M. intracellulare* were prominent among the isolates. Analysis of local water treatment plants suggests that post-treatment conditions can impact microbial regrowth: for instance, prolonged stagnation after chlorination was associated with increased NTM persistence. Differences in treatment processes and source water also led to distinct microbial community profiles, potentially influencing NTM abundance. Furthermore, our tests showed that sample handling methods (e.g., transport conditions) can significantly affect measured bacterial counts, underscoring the importance of standardized protocols for water microbiology studies.

To explore infection source-tracking, we integrated geographic information system (GIS) mapping of NTM patient cases with environmental data. A spatial analysis of 130 pulmonary NTM cases in one region (Fukuoka, Japan) did not reveal clustering around major water bodies or infrastructure, suggesting that infections arise from sporadic, localized exposures rather than a single point source. Consistent with this, NTM infections in the community occur sporadically with no evidence of direct human-to-human transmission. Ongoing investigations are examining the role of aerosolized water (e.g., from showers) as a route of NTM exposure.

Our findings highlight that NTMs are an invisible yet important component of water ecosystems with direct relevance to public health. Even under standard water treatment regimes, these bacteria can persist and proliferate in distribution networks and household plumbing. This work underscores the need for improved water management practices—such as minimizing water stagnation and maintaining appropriate residual disinfection—to control NTM growth. An interdisciplinary approach combining water quality management,

microbiological monitoring, and epidemiological analysis is essential to mitigate the risk of NTM infections arising from water resources. These insights can inform the development of guidelines to monitor and control NTM in drinking water systems.

Plenary Speech

AVIAN INFLUENZA VIRUS H9N2: THE SILENT TROJAN HORSE OF THE NEXT INFLUENZA PANDEMIC AND THE ROLE OF WATER BODIES IN ITS DISSEMINATION

Thusitha Karunarathna

Department of Veterinary Public Health and Pharmacology, University of Peradeniya

H9N2 avian influenza viruses represent a significant global threat to both animal and human health. Although vaccination remains a key strategy for reducing the impact of disease, these viruses continually evolve to evade vaccine-induced immunity through mutations in the haemagglutinin (HA) glycoprotein.

We identified an immune escape mutation in an H9N2 virus that emerged under selective pressure from homologous antisera. This variant lost its ability to agglutinate chicken erythrocytes, yet retained replication efficiency comparable to the wild-type virus in chicken embryos and cultured cells. The mutation involved a substitution of glycine (G) with glutamic acid (E) at a specific position in the HA protein, introducing a shift from a neutral to a negatively charged residue. We hypothesized that this charge alteration affects the interaction between HA and erythrocyte receptors. Supporting this, agglutination activity was restored when the E residue was replaced by positively charged amino acids histidine (H), arginine (R), or lysine (K).

Furthermore, environmental factors exacerbate this risk, including the role of water bodies in maintaining and disseminating viruses. Avian influenza viruses [AIVs] are widely enzootic in many different types of birds globally. AIVs can also cause zoonotic infections in humans and contribute to the emergence of pandemic influenza viruses, posing a public health concern worldwide. The natural hosts of AIVs are wild birds, with AIVs largely found in wild waterfowl like ducks, geese, and swans, as well as shorebirds like turns, and domestic poultry such as chickens and turkeys. Aquatic environments, including wetlands, lakes, and irrigation systems, serve as natural reservoirs and transmission interfaces for avian influenza viruses. Virus stability in water enables prolonged environmental persistence, facilitating indirect transmission among domestic birds, wild waterfowl, and other susceptible species. The intersection of viral evolution, host ecology, and environmental contamination creates an ideal setting for sustained circulation and potential reassortment events involving AIVs. These factors highlight the complex interplay between antigenic variation, viral functional traits, and complex environmental factors, reinforcing the urgent need for continuous monitoring and in-depth research to mitigate the potential risks posed by AIVs, including H9N2 avian influenza viruses.

Plenary Speech

INNOVATIONS IN PHYSICOCHEMICAL AND BIOLOGICAL WATER TREATMENT PROCESSES

Subhashini Gunathilake

Department of Chemistry, University of Peradeniya

Growing pressures on global water resources—driven by population growth, rapid industrialization, and the emergence of recalcitrant contaminants—necessitate transformative advances in water and wastewater treatment. Conventional physicochemical and biological treatment systems, while effective for traditional pollutants, face significant limitations when confronted with complex industrial effluents, micropollutants, antibiotic residues, and nutrient-rich waste streams. This presentation explores recent innovations across both physicochemical and biological treatment domains, with emphasis on technologies capable of delivering higher efficiency, enhanced selectivity, reduced energy consumption, and improved sustainability.

Key physicochemical advancements include the development of advanced oxidation processes (AOPs) capable of generating highly reactive radical species for the degradation of persistent organic pollutants, the synthesis of novel adsorbent materials such as metal organic frameworks, covalent organic frameworks, and graphene-based composites, and the emergence of nano- and bio-coagulants offering improved performance with lower chemical demand. Breakthroughs in membrane science, particularly nanocomposite and biomimetic membranes, are enabling higher flux, lower fouling, and better separation of micropollutants.

On the biological front, engineered microbial consortia, synthetic biology approaches, and high-rate anaerobic systems are expanding the ability of biological treatment to handle complex and variable wastewaters. Processes such as Anammox, enhanced biological phosphorus removal, and algal or fungal bioremediation offer energy-efficient pathways for nutrient removal and resource recovery. Hybrid systems that strategically combine physicochemical and biological processes, such as AOP-biological cascades and membrane bioreactors, demonstrate synergistic effects, yielding enhanced degradation, reduced toxicity, and improved resilience.

Collectively, these innovations point toward a future of more adaptive, sustainable, and high-performance water treatment systems capable of addressing emerging global challenges.

WATER QUALITY

WQ01

SPATIAL INEQUALITIES IN WATER ACCESS: MAPPING URBAN-RURAL DISPARITIES IN KANDY, SRI LANKA

P.G.T. Poornika*, P.G.R.A. Nayanthima and R.M.K. Kumarihamy

Department of Geography, University of Peradeniya, Peradeniya, Sri Lanka

Ensuring access to safe and reliable drinking water has emerged as a pressing global concern, particularly in the context of climate change and increasing population pressures. While Sri Lanka is often perceived as a country less vulnerable to water scarcity compared to other regions, the island faces growing risks from seasonal rainfall variability, groundwater depletion, pollution, and poor water governance. Water scarcity in Sri Lanka is not always about absolute shortage, but rather about inaccessibility caused by uneven distribution, weak infrastructure, and contamination. Without effective interventions, these challenges threaten to escalate, affecting both human health and sustainable development. This study aims to map the spatial distribution of water access, examine how demographic factors influence urban-rural disparities, and identify priority areas of inequality to support sustainable water management and equitable service delivery. The study relies on secondary data sources, particularly Grama Niladhari (GN) division-level data in Kandy District from the 2012 Census of Population and Housing. Data were analyzed using the Urban-Rural Water Access Index, which categorized water sources into safe sources (piped/tap water), more prevalent in urban settings, moderately safe sources (protected wells, tube wells, bottled water, rural water schemes) and unsafe sources (unprotected wells, rivers/tanks/streams and untreated sources), which are more common in rural areas. The analysis reveals striking disparities in domestic water access. For example, Wellethota (Medadumbara) and Aruppala East (Kandy Four Gravets) reported 100% safe water coverage, while Rangala Aluthwatte (Medadumbara), Galamuduna (Minipe), and Kobonilla (Udadumbara) had 100% unsafe reliance. A considerable number of GNDs fall into intermediate categories, with Gallenawatta and Alawattegama (Thumpane) among those depending entirely on moderately safe sources. Overall, 43.63% GNDs reported safe access, 8.52% GNDs had unsafe reliance, and 47.85% GNDs had moderate reliance. While the findings highlight significant inequities in domestic water access across peri-urban, urban, and rural areas in the Kandy District, the analysis is constrained by its reliance on 2012 census data. Water supply conditions may have changed over the past decade, particularly in Medadumbara, Minipe, and Udadumbara, where Community-Based Organizations have implemented water improvement initiatives in recent years. Therefore, updated spatial and household-level assessments are essential to understand the current realities and guide evidence-based decisions for water infrastructure planning that ensure safe, equitable water access for all communities.

Keywords: Access Index, Community-Based Organizations (CBOs), Safe Water Access, Urban-Rural Disparities, Urban-Rural Water, Water Scarcity

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WQ02

GROUNDWATER QUALITY ASSESSMENT IN THE DRY ZONE: A PILOT STUDY OF A SPECIFIC AGRICULTURAL AREA IN NOROCHCHOLAI, SRI LANKA

I. Hewage[1,2], J.A.T.C. Ariyasena[1] and H.A.M. Prasadani[2,*]

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Access to safe and adequate freshwater is indispensable for the survival of all living entities. Used in productive and consumptive activities, groundwater emerges as a vital natural resource, specifically in the country's dry zone, with a remarkable contribution to livelihoods in numerous ways. Due to the unprecedented increase in the human population over the past few decades, a pronounced impact on the environment has occurred, leading to a rapid rate of urbanization and intensified expansion of agricultural practices. Consequently, a progressive and continual degradation of resources, including groundwater, has occurred, emphasizing the need for pilot studies to evaluate groundwater quality in such areas. The cash crop farming community in Norochcholai, Sri Lanka, relies entirely on groundwater abstracted from the shallow coastal sand aquifers along the north-south coastal stretch, creating the Kalpitiya Peninsula, where one of the gratifying unconfined coastal aquifers characterized by its shallow nature and sandy aquifer media is found. A tube well located at Narakkalliya Grama Niladhari Division (08°00'426" N; 79°72'961" E) belonging to Kalpitiya District Secretariat Division of Puttalam District, where intensive agricultural activity was observed, was selected and sampled for the pre- and post-monsoonal seasons from 2020 to 2025. Physical and chemical water quality parameters were analyzed and compared to SLS 614:2013 drinking water quality standards. While shedding depth insights into complex relationships between water quality parameters, the study divulged strong impacts of seasonal variations on groundwater quality alterations in the promptly recharging shallow aquifers in the study location. Wide variation was observed in the measured groundwater quality parameters, with pH ranging from 7.0-9.3, electrical conductivity 147-33,649 μS cm^{-1}, total dissolved solids 734-1866 mg L^{-1}, turbidity 0.05-3.11 NTU, fluoride 0.2-2.3 mg L^{-1} as F^-, total iron 0.030-0.626 mg L^{-1} as Fe, nitrate 8.0-372.0 mg L^{-1} as NO_3^-, phosphate 0.4-3.5 mg L^{-1} as PO_4^{3-}, sulfate 370-820 mg L^{-1} as SO_4^{2-}, total hardness 604-1,960 mg L^{-1} as $CaCO_3$, total alkalinity 12-560 mg L^{-1} as $CaCO_3$, calcium 123-442 mg L^{-1} as Ca^{2+}, magnesium 20-242 mg L^{-1} as Mg^{2+}, and chloride 221-632 mg L^{-1} as Cl^-. However, despite the dilution effects during the post-monsoonal season, it was revealed that the sampled tube well water has persistent issues concerning hardness, total dissolved solids, calcium, magnesium, chloride, sulfate, and nitrate, thus indicating its unsuitability as a source of potable water, as they exceeded the SLS 614:2013 maximum permissible limits. Natural sources, such as surface runoff from precipitation and irrigation return flow, as well as anthropogenic sources, such as extreme applications of fertilizer and severe groundwater extraction, were attributed to groundwater quality degradation.

Keywords: Norochcholai, Seasonal variations, SLS 614:2013 drinking water quality standards

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WQ03

EVALUATION OF DRINKING WATER SAFETY AND DISTRIBUTION SYSTEM INTEGRITY: A CASE STUDY OF THE KANDY SOUTH WATER TREATMENT PLANT, SRI LANKA

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Ensuring the safety of drinking water at the consumer end is a critical public health concern, as the quality of drinking water can significantly deteriorate between the treatment plant and the point of consumption due to hydraulic variations, long residence times, and aging infrastructure. In Sri Lanka, monitoring mostly focuses on treatment outlets, leaving a gap in understanding the integrity of the distribution networks. This study investigated the physicochemical and microbiological parameters of drinking water throughout the distribution system of the Kandy South Water Treatment Plant, which gets its water from the Mahaweli River. Water samples were collected from three critical points in the supply chain: the river surface water at the intake point, the treated water at the treatment plant outlet, and multiple locations along the distribution network. Water samples were collected twice per month over three months from July to September 2025 and analyzed for key physicochemical parameters such as pH, temperature, TDS, EC, hardness, and anions (chloride, fluoride, nitrate, sulfate) and microbiological quality (*Escherichia coli*). All parameters were within the permissible range as per the Sri Lanka Standard Specification for potable water (SLS614:2013). Raw surface water and treated water are suitable for drinking according to the Water Quality Index. The study shows that the Kandy South Water Treatment Plant produces and distributes water that meets national drinking water standards. Throughout the sampling period, there was no significant decline in the physicochemical or microbiological quality observed in the distribution network.

Keywords: Distribution system integrity, Drinking water safety, Water quality index, Water treatment plant

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WATER POLLUTION

WP01

WASTEWATER SURVEILLANCE IN WESTERN PROVINCE, SRI LANKA: ASSESSING PUBLIC HEALTH RISKS AND ENVIRONMENTAL IMPACTS

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Wastewater-based epidemiology (WBE) is an emerging tool for monitoring public health threats and assessing environmental quality. This study evaluates the dual role of wastewater surveillance in the Western Province of Sri Lanka, focusing on both public health assessment and environmental impacts. A total of 33 wastewater samples were collected from diverse urban and semi-urban sites, including university hostels, wastewater treatment plants, residential housing schemes, river effluent mixing points, open dumping sites, hospitals, coastal areas, and polluted canals. Bacterial and viral indicators were screened, including *Salmonella* spp., *Shigella* spp., *Escherichia coli* O157, Dengue virus, SARS-CoV-2 virus, and Influenza A and B viruses. Nutrient levels (N-nitrite, N-nitrate, N-ammonia, total phosphorus) and physicochemical parameters (pH, temperature, dissolved oxygen, electrical conductivity, chemical oxygen demand, oil and grease) were analyzed following standard methods. Culture-based methods with biochemical confirmation were used for *Salmonella* spp. and *Shigella* spp., while *E. coli* O157 was detected using an optimized PCR protocol. Viral detection was performed with advanced molecular techniques. The results revealed significant public health and environmental risks. Among the 33 samples, bacterial prevalence was 100% for *Salmonella* spp., 15.2% for *Shigella* spp., and 18.2% for *E. coli* O157. The highest overall bacterial occurrence was observed in hospital wastewater, open dumping sites, river outfalls, and coastal canals. Viral pathogens were not detected. While 70% nutrient and physicochemical parameters, including pH, temperature, electrical conductivity, N-nitrite, N-nitrate, N-ammonia, and total phosphorus, were within Sri Lanka Standards for wastewater (SLSI), 36.36% of samples failed to meet acceptable dissolved oxygen levels ($\geq$ 3 mg L^{-1}), 39.39% exceeded Chemical Oxygen Demand (COD) limits (250 mg L^{-1}) and 96.97% showed elevated oil and grease concentrations (10 mg L^{-1}). The findings of the study demonstrate the critical role of WBE as a cost-effective tool for identifying pollution hotspots, potential disease outbreaks, and environmental degradation. Integrating wastewater surveillance into national health monitoring and environmental management policies can support sustainable urban development, guide sanitation interventions, and safeguard public health in rapidly urbanizing areas such as Sri Lanka's Western Province.

Keywords: *Escherichia coli* O157, Influenza virus, SARS-CoV-2 virus, *Salmonella* spp., *Shigella* spp.

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WP02

ASSESSMENT OF WATER QUALITY AND FECAL CONTAMINATION IN SELECTED SITES OF KALPITIYA LAGOON, SRI LANKA

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Kalpitiya Lagoon, located in northwestern Sri Lanka, is recognized as a vital coastal ecosystem that supports oyster farming. Safe water is a key requirement for both sustainable aquaculture and public health. Assessment of fecal coliform contamination remains a prerequisite in this regard. This study was carried out to study the presence of fecal coliforms in oysters and lagoon water, along with the physicochemical water quality. Samples were collected from Kandakuliya, Kudawa, and Meegamuwadiya in the Kalpitiya Lagoon in August 2025. Adult Indian oysters (*Crassostrea madrasensis*; $n = 10$ per site) and water samples ($n = 3$ per site) were collected for microbial screening (300 mL each) and water quality analysis (500 mL each). *C. madrasensis* soft tissues were homogenized after removing the gut and directly cultured on MacConkey agar for isolation and enumeration of fecal coliforms. The membrane filtration technique was used for the detection of fecal coliform contamination in lagoon water. Results were statistically analyzed using the Mann-Whitney U test (SPSS Statistics ver. 22, IBM). *In-situ* and *ex-situ* parameters of water quality were analyzed in collected water samples; pH, temperature, and salinity were tested in the field itself using the multi-parameter probes and the salinity meter, respectively. Total nitrogen, total phosphorus, dissolved oxygen (DO), and biological oxygen demand (BOD) were determined at the laboratory following standard spectrophotometric and titrimetric methods. The physico-chemical parameters across all three sites varied as follows: pH (8.0-8.2), temperature (31.67-30.4 °C), salinity (35,000-36,000 mg L^{-1}), DO (1.07-1.33 mg L^{-1}), BOD (0.56-0.83 mg L^{-1}), total nitrogen (0.66-0.17 mg L^{-1}), and total phosphorus (0.04-0.05 mg L^{-1}). Statistical analysis revealed a difference between fecal coliform counts in oysters from Kandakuliya (63.71±16.13 CFU mg^{-1} oyster tissue) with those of Meegamuwadiya (2.66±1.33; $p < 0.05$). Meanwhile, oysters in Kudawa showed a count of 20.68±11.36 CFU mg^{-1} oyster tissue. Interestingly, non-coliform enteric colonies were also identified from all three sites: 10.33±7.49 (Kandakuliya), 9.69±8.81 (Kudawa), and 0.19±0.09 (Meegamuwadiya) CFU mg^{-1} oyster tissue. No significant difference in fecal coliform counts was observed in water, across the sampling sites: Kandakuliya (2.33±0.58 CFU 100 mL^{-1}), Kudawa (5±3 CFU 100 mL^{-1}), and Meegamuwadiya (7±2 CFU 100 mL^{-1}), all of which were well below the U.S. Food and Drug Administration (FDA) threshold of 14 CFU 100 mL^{-1}, for safe shellfish harvesting waters. In conclusion, the water in Kalpitiya Lagoon meets international standards for safe shellfish harvesting. However, the observed non-coliform enteric colonies in oysters require further identification, and the microbial quality of oysters after depuration needs to be assessed.

Keywords: Fecal coliforms, Indian backwater oyster, Kalpitiya, Water quality

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WP03

SEASONAL VARIATIONS IN WATER QUALITY AND POLLUTION DYNAMICS IN THE KELANI RIVER BASIN, SRI LANKA

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The Kelani River is a critical freshwater source, providing approximately 80% of the drinking water to the Colombo District, which is home to over six million residents. However, unregulated industrial and domestic waste, along with agricultural runoff, have degraded the Kelani River's water quality, which in turn affects public health and aquatic biodiversity. This study assessed seasonal variations in water quality and evaluated water suitability within the Kelani River Basin using the Canadian Council of Ministers of the Environment Water Quality Index (CCME-WQI) integrated with Geographic Information System (GIS) techniques. Seventy-one surface and groundwater samples were collected, covering both the dry and wet seasons. Water quality parameters, including pH, Total Phosphorous (TP), Ammonium-Nitrogen (NH_4^+-N), Nitrate-Nitrogen (NO_3^--N), Nitrite-Nitrogen, Total Nitrogen (TN), Fecal Coliform (FC), Total Coliform (TC), Dissolved Oxygen (DO), and Electrical Conductivity (EC), were analyzed following American Public Health Association (APHA) protocols and standard microbiological methods. WQI values were computed based on Sri Lanka Standards for Drinking Water (SLSI) and World Health Organization guidelines. Results classified the Kelani River's water quality as "Marginal," with WQI values ranging from 93 at the headwaters to 26 in the meandering zone. Groundwater exhibited an average WQI of 65±17, while surface water averaged 59±17. Correlation analysis indicated that NH_4^+-N and TP were the primary factors influencing WQI, with NH_4^+-N showing the strongest negative correlation ($R > -0.7$, $p < 0.001$). Field observations confirmed that industrial and domestic wastewater, poor sanitation, and agricultural runoff are the major contributors to water contamination. These findings highlight the urgent need for advanced water treatment technologies, stricter pollution control measures, and sustainable river basin management strategies to safeguard public health and water resources in the Kelani River Basin, Sri Lanka.

Keywords: CCME-WQI, Kelani River, Seasonal water quality variation, Water pollution

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WP04

DEGRADATION OF BIODEGRADABLE PRODUCTS IN LAGOON ECOSYSTEMS AND THEIR CONTRIBUTION TO MICROPLASTIC POLLUTION

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Lagoons are shallow coastal water bodies that function as natural buffers, absorbing excess inland water and channeling it into the ocean. However, the accumulation of non-degradable debris from domestic and agricultural waste causes severe ecological damage to these ecosystems. Hence, biodegradable and compostable products have been designed as environmentally friendly alternatives to break down in natural environments more rapidly compared to conventional plastics. The present study evaluated the degradation potential of three commercial product types: a biodegradable salad plate, a compostable lunch sheet, and an oxo-degradable garbage bag in the Negombo lagoon, Sri Lanka (07°12'068" N; 79°50'197" E). The test samples were cut into 1-3 g pieces, cleaned, and secured in a nylon net cage in triplicate and deployed in the lagoon for six months. Degradation was quantified by comparing initial and final dry weights to determine mass loss. Structural, mechanical, and chemical changes were assessed using Scanning Electron Microscopy (SEM), tensile strength testing, and Fourier transform infrared (FTIR) spectroscopy (ATR mode), respectively. Results showed that both the salad plate and lunch sheet samples fully degraded (100%) within 90-120 days, whereas the garbage bag exhibited only 7.73% mean weight loss over the entire study period. SEM images revealed fiber coagulation, pits, cracks, and surface flaking with an overall reduction in sample thickness over time. Mechanical testing demonstrated significant reductions in tensile strength (F_b) and elongation at break (ε_b) for the salad plate (ΔF_b = -75.30%; $\Delta\varepsilon_b$ = -70.70%), but an increase in both parameters for the garbage bag (ΔF_b = 53.02%; $\Delta\varepsilon_b$ =1679.47%). Due to excessive brittleness, the lunch sheet samples were not subjected to mechanical testing from the initial sampling phase onwards. FTIR analysis confirmed the loss of characteristic peaks of cellulose in the salad plate and polyester in the lunch sheet, indicating chemical degradation. In contrast, the garbage bag retained all characteristic peaks of low-density polyethylene (LDPE), suggesting negligible chemical degradation and the persistence of micro-sized LDPE particles. These findings demonstrate that oxo-degradable plastics show limited degradation in lagoon environments, increasing the risk of long-term microplastic pollution, and highlight the importance of critically evaluating "biodegradable" product claims and their environmental implications in tropical aquatic ecosystems.

Keywords: Biodegradable products, Lagoon environment, Microplastic pollution, Oxo-Degradable, Oxo-LDPE

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WP05

ASSESSMENT OF SELECTED POLYCYCLIC AROMATIC HYDROCARBON (PAHS) CONTAMINATION AND WATER POLLUTION IN HARBORS AND AQUACULTURE AREAS IN NORTHERN AND SOUTHERN PROVINCES, SRI LANKA

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Polycyclic Aromatic Hydrocarbons (PAHs) are a group of Persistent Organic Pollutants (POPs) derived from pyrogenic and petrogenic sources, posing serious ecological and human health risks in coastal environments. This study assessed water pollution levels and PAH contamination in marine waters from fishery harbors and aquaculture areas in the Northern and Southern Provinces of Sri Lanka. Water samples were collected from 27 locations ($n = 3$ per site) and analyzed for three priority PAHs: phenanthrene, naphthalene, and anthracene. Liquid-liquid extraction followed by high-performance liquid chromatography was used for quantification, while physicochemical parameters were measured to evaluate overall water quality. Dissolved oxygen, pH, electrical conductivity, nitrate, and nitrite levels were within acceptable limits, whereas the highest oil and grease content (4.11 ± 0.02 mg L^{-1}) was recorded at Galle Fishery Harbor. PAHs concentrations varied across sites, with phenanthrene ranging from undetectable to 4.77 mg L^{-1}, naphthalene from undetectable to 20.95 mg L^{-1}, and anthracene from undetectable to 1.45 mg L^{-1}. Mirissa Fishery Harbor exhibited the highest naphthalene and anthracene concentrations, while Galle Fishery Harbor recorded the highest phenanthrene levels. The PAH levels in the studied areas exceeded the maximum permissible concentrations set by the European Union (2×10^{-4} mg L^{-1}) and the United States Environmental Quality Criteria (3×10^{-5} mg L^{-1}), indicating significant contamination. The predominance of low-molecular-weight PAHs, particularly naphthalene and phenanthrene, suggests mixed pyrogenic and petrogenic origins, likely associated with fuel combustion, vessel discharges, and oil-handling operations at harbors. Spatial analysis revealed significantly higher PAH concentrations in Southern harbors compared to Northern sites, likely due to increased shipping activity, oil spills, and industrial discharges. Northern aquaculture areas showed moderate contamination with mixed pyrogenic and petrogenic sources. These findings provide critical baseline data, identifying Southern harbors as key pollution hotspots and highlighting the need for targeted monitoring and management strategies to mitigate oil and chemical-related pollution in Sri Lankan coastal ecosystems.

Keywords: Anthracene, Naphthalene, Phenanthrene, Polycyclic Aromatic Hydrocarbons, Water quality

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WP06

EVALUATION OF WATER QUALITY AND ANTHROPOGENIC INFLUENCES IN BEDDAGANA WETLAND PARK, SRI LANKA

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Urban wetlands play a vital role in regulating floods, maintaining biodiversity, and providing recreational value within cities. However, they are increasingly threatened by anthropogenic pressures. This study assessed water quality at 25 sampling sites within Beddagana Wetland Park (18 ha), located in a highly urbanized region of Sri Lanka's Western Province on the floodplains of Diyawanna Oya. Both physicochemical and microbiological parameters were analyzed to evaluate human impacts and provide baseline data for wetland management. Field measurements (n = 25) included temperature, pH, dissolved oxygen (DO), conductivity, and total dissolved solids (TDS), while laboratory analyses assessed nutrient levels (nitrate, nitrite, ammonia, phosphate), chemical oxygen demand (COD), biological oxygen demand (BOD), oil and grease concentrations, and coliform bacteria counts. Results revealed that temperature, pH, conductivity, total phosphorus, total nitrogen, and oil and grease ranges were 27.4-32.1 °C, 3.92-7.97, 151.6-476 µS cm^{-1}, 0.14-4.06 ppm, 0-10.43 mg mL^{-1}, and 0.02-5.61 mg L^{-1}, respectively. Elevated COD (up to 38.4 mg L^{-1}), BOD (up to 24.3 mg L^{-1}), nutrient enrichment, and high *Escherichia coli* and total coliform counts (> 200 CFU 100 mL^{-1} at most sites) indicated severe fecal contamination and water quality deterioration, particularly near residential settlements and effluent discharge points. These findings demonstrate that anthropogenic inputs have significantly altered the wetland's natural hydrology and nutrient balance, leading to habitat degradation, reduced water quality, and potential biodiversity loss due to eutrophication and algal blooms. To mitigate these impacts, integrated wetland management strategies such as restoration of natural flow regimes, establishment of buffer vegetation zones, stricter control of wastewater discharge, and enhanced community-based conservation programs are recommended. This study provides essential baseline data to guide sustainable wetland conservation, urban planning, and ecosystem rehabilitation initiatives in Sri Lanka.

Keywords: Microbiological contamination, Nutrient analysis, Urban wetland, Water pollution, Wetland conservation

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WP07

PREVALENCE AND DETECTION OF ANTIBIOTIC-RESISTANT BACTERIA AND ANTIBIOTIC RESIDUALS IN SOLID WASTE DUMP LEACHATE IN SRI LANKA

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Antibiotic resistance is a major global challenge that poses a serious and often underestimated threat to public health in the near future. Solid waste dump sites serve as the source of antibiotic residues due to the accumulation of municipal solid waste. The focus of the present study was to determine the antibiotic resistance and antibiotic residues in leachate collected from three urban, semi-urban, and rural dump sites, including Karadiyana, Kegalle, and Mathugama. In the present study, the Minimum Inhibitory Concentration (MIC) and Multiple Antibiotic Resistance (MAR) were determined against penicillin group antibiotics (AMX, AMP, CLOX), Tetracyclines (TET, OTC), and sulfonamides group antibiotics (SUF, SDI), Co-amoxiclav (AUG), Ciprofloxacin (CIP), Gentamicin (GEN), and Azithromycin (AZY) using standard methods given by CLSI guidelines. The antibiotic residues were determined using the optimized HPLC method, and the characterization of leachate was carried out following the APHA standard methods. Based on the results of leachate characterization, the Chemical Oxygen Demand (COD), NO_3^-, NO_2^-, NH_4^+, and Total Phosphate values of leachates were significantly different ($p < 0.05$) among the three selected dump sites. Further, they exceeded the maximum tolerance level with reference to Sri Lanka water quality standards. The highest level of antibiotic resistance was observed for AMX, particularly in Mathugama (11.21%) and Kegalle (10.34%), suggesting extensive use or possible misuse of this antibiotic. There is also a significant level of GEN-resistant bacteria in Mathugama (6.02%), which is higher than in all the other locations. There were also moderate resistance rates for AZY, CIP, and AUG, while TET, OTC, SDI, and SMX showed no resistance levels. The MAR index range varied from 0.75 to 1 for the isolates. The finding that 96.88% of isolates exhibited a MAR index of 1 underscores widespread resistance to all nine antibiotics at 60 ppm, with only a small fraction (3.125%) showing slightly lower resistance (MAR = 0.75). Importantly, the antibiotic residues were not detected in the tested samples. However, the proper treatment of wastewater, strengthened regulation of antibiotic disposal, and frequent monitoring of antibiotic resistance in leachates are needed to reduce the risk to human and other living beings' health.

Keywords: Antibiotic resistance**,** Leachate, Penicillin, Tetracycline

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WP08

PHENOTYPIC CHARACTERIZATION AND MOLECULAR DETECTION OF *Pseudomonas* spp. IN DRINKING WATER SOURCES OF GAMPAHA DISTRICT, SRI LANKA

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Pseudomonas species are Gram-negative bacteria with a broad ecological distribution, inhabiting diverse environments, such as water, soil, and plant surfaces. They are well-recognized opportunistic pathogens capable of causing a wide spectrum of infections and are frequently associated with multidrug resistance. This study aimed to detect *Pseudomonas* spp. in drinking water sources across Gampaha District, a densely populated lowland region of Sri Lanka. A notable research gap exists, as no previous studies have investigated the presence of *Pseudomonas* spp. across different drinking water sources in this region. A total of 38 water samples were aseptically collected from various drinking water sources in Gampaha District, including wells (n = 11), taps (n = 15), and bottled water obtained from restaurants (n = 12), during February-May 2025. Characteristic colonies of *Pseudomonas* spp. cultured on Glutamate Starch Phenol Red (GSP) agar were phenotypically characterized through Gram staining and a series of standard biochemical assays. All isolates were confirmed as Gram-negative, rod-shaped, oxidase-positive, and non-fermentative. Phenotypically characterized *Pseudomonas* isolates were subjected to molecular confirmation using polymerase chain reaction (PCR) with *Pseudomonas* genus-specific 16S rRNA primers. Thirty-two (32) isolates were initially identified as *Pseudomonas* spp. through phenotypic profiling, but only 29 were confirmed by PCR. Eighteen (18) of the 38 water samples (47.4%) tested positive for *Pseudomonas* spp. The positive water samples included all well water samples, 33.3% of tap water samples, and 16.7% of bottled water samples. This study provides the first molecular evidence of the occurrence of *Pseudomonas* spp. across various drinking water sources in this region. The current findings indicate potential shortcomings in existing water treatment practices, highlighting concerns regarding microbial contamination and associated public health risks. These results underscore the necessity for regular microbial surveillance and the optimization of disinfection strategies. Further studies, including antimicrobial resistance profiling, speciation, assessment of virulence determinants, and species-level confirmation of *Pseudomonas* spp., are needed to comprehensively evaluate their pathogenic potential and public health impact.

Keywords: Drinking water, Molecular detection, Phenotypic characterization, *Pseudomonas* spp., Public health

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WP09

RAPID DETECTION OF ELECTROACTIVE PESTICIDES IN WATER BY MICROCHIP ELECTROPHORESIS

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Pesticide contamination has emerged as one of the most pressing environmental challenges in recent decades, particularly in developing nations where agricultural intensification relies heavily on chemical pest control. Among various environmental compartments, surface and groundwater bodies are the most vulnerable, as pesticides are transported through runoff, leaching, and improper disposal practices. These contaminants not only compromise the quality of drinking water but also threaten aquatic ecosystems, biodiversity, and public health. Conventional detection techniques, such as gas chromatography, high-performance liquid chromatography, and mass spectrometry, although highly sensitive, are often limited by high cost, complex instrumentation, time-consuming sample preparation, and the need for skilled personnel. Separation is necessary because pesticide residues constitute a complex mixture. Microchip electrophoresis coupled with electrochemical detection offers a rapid, miniaturized, and portable approach for both separation and detection. Therefore, in this study, we explored microchip electrophoresis coupled with electrochemical detection, a fast, low-cost strategy for separating and detecting electrochemically active pesticides used in Sri Lanka. Preliminary studies were carried out to identify the optimal conditions for obtaining electrochemical responses from the pesticides profenofos, carbosulfan, and fipronil. Cyclic voltammetry in 10 mmol L^{-1} borate buffer (pH 10, scan rate 50 mV s^{-1}) demonstrated distinct electrochemical activity of these selected pesticides on the glassy carbon working electrode. Profenofos exhibited a strong and well-defined oxidation peak at approximately +0.6 V, reaching a current response of about 45 µA, confirming its high electroactivity. Carbosulfan showed a clear oxidation peak near +0.4 V with a current of nearly 10 µA, indicating stable redox behavior. In contrast, fipronil displayed only a small oxidation signal between +0.6 and +0.8 V, with a peak current of approximately 7 µA, reflecting weaker electrochemical activity under the tested conditions. A polydimethylsiloxane (PDMS) based microfluidic device integrated with carbon and gold electrodes is currently being tested to separate multiple pesticides by electrophoresis, followed by detection using amperometry. In conclusion, this research highlights the successful fabrication and application of a PDMS-based microfluidic electrochemical device for pesticide analysis in water samples. The results demonstrate that microfluidics coupled with amperometric detection can provide an effective and environmentally sustainable solution for real-time monitoring of pesticide residues in water. The device holds promise for applications in environmental surveillance, water quality management, and public health protection, ultimately contributing to the reduction of pesticide-related water pollution.

Keywords: Amperometry, Cyclic voltammetry, PDMS microfluidics, Pesticides, Water pollution

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WP10

DETERMINATION OF AIR QUALITY THROUGH ANALYSIS OF RAINWATER IN SELECTED GEOGRAPHICAL AREAS IN KANDY AND KALUTARA DISTRICTS

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Rainwater serves as a natural indicator of atmospheric composition, and analyzing its chemistry provides valuable insight into air quality in various geographical regions. The combined form of atmospheric wet deposition and dry deposition, referred to as bulk deposition, is usually analyzed to determine the extent of air pollution, as the dissolution of pollutants alters the chemistry of rainwater. Such measurements can also be used to develop suitable environmental models for the prediction of the suitability of rainwater for various uses. In this context, this study aimed to study the chemical characteristics of bulk precipitation in selected areas, namely Kandy, Peradeniya, and Horana, over a period of 15 weeks from 13th April 2025 to 27th July 2025, collecting weekly samples and analyzing them for water quality parameters, using standard analytical methods. The average rainfall values of the three sites, Kandy, University of Peradeniya (UOP), and Horana, were 39.41 mm, 39.34 mm, and 67.66 mm, respectively, with 20%, 20% and 7% dry-only precipitation, while acidic precipitation of pH < 5.6 was observed at UOP and Horana sites only. The average conductivity and TDS at the three sites were 36.03 μS cm^{-1}, 26.24 μS cm^{-1}, and 22.01 μS cm^{-1}, and 24.96 mg L^{-1}, 18.01 mg L^{-1}, and 15.05 mg L^{-1}, respectively. Moreover, the total hardness values at the sites were 15.29 mg L^{-1}, 9.48 mg L^{-1} and 8.51 mg L^{-1}, respectively, indicating that rainwater in all three sampling sites was generally soft. The samples at the Horana site had the lowest pollutant content, while the water at the Kandy site had the highest ionic content and salinity, compared to the other two sampling sites. indicating a greater presence of minerals/contaminants in the atmosphere around Kandy. However, this study should be continued for a longer period for a reliable prediction of atmospheric quality. The influence of localized anthropogenic and geographic factors on atmospheric deposition should also be considered to aid such regional studies for the management of atmospheric quality.

Keywords: Conductivity, Hardness, pH, Salinity, TDS

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WATER TREATMENT

WT01

BIOREMEDIATION OF PHOSPHATE IN DIVERSE WASTEWATER STREAMS USING SOIL-DERIVED BACTERIAL ISOLATES

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The escalating discharge of wastewater from diverse human activities underscores the need for sustainable and environmentally friendly treatment strategies to safeguard both ecosystems and public health. Traditional chemical methods for phosphate removal can cause secondary environmental impacts, highlighting the importance of exploring biological alternatives. This study investigated the capacity of bacteria isolated from soil to reduce phosphate concentrations in four different wastewater types: Agricultural runoff (AG), Aquaculture effluent (AQ), Automobile wastewater (AU), and Cafeteria discharge (CT). Bacterial strains were isolated from soil using the spread plate technique and characterized based on colony morphology and basic biochemical characteristics. The isolated strains were subsequently employed in phosphate reduction assays, which identified three dominant isolates**:** a Gram-positive, catalase-negative *Coccus* sp. (cluster-forming, circular colonies) and two *Bacillus* species (one small rod-shaped and one long rod-shaped). A laboratory-scale experiment was carried out following a Completely Randomized Design (CRD) with seven treatments (T1-T6 involving microbial inoculations and T7 as a negative control), each replicated three times across all four wastewater types. Treatments consisted of single and combined applications: T1 (long rod-shaped *Bacillus* sp.), T2 (*Coccus* sp.), T3 (small rod-shaped *Bacillus* sp.), T4 (T1+T2), T5 (T1+T3), T6 (T2+T3), and T7 (control without inoculation). The combinations were used to evaluate possible synergistic effects that may enhance phosphate removal efficiency. The Ascorbic Acid (Molybdenum Blue) method was used to determine the phosphate concentration. The results showed significant reductions in phosphate concentrations ($p < 0.05$) for AG ($p = 0.014$), AQ ($p = 0.016$), and AU ($p = 0.001$), confirming the effectiveness of these bacterial treatments. Conversely, no significant reductions were observed in CT ($p = 0.045$), possibly due to the presence of resistant or recalcitrant phosphate compounds. These findings indicate that certain soil-derived bacterial strains could function as environmentally friendly agents for phosphate removal in specific wastewater streams. Further research, including molecular identification of these isolates and pilot-scale studies, is recommended to assess their feasibility in real-world wastewater treatment systems.

Keywords: Ascorbic acid method, *Bacillus* sp., *Coccus* sp., Phosphate removal, Soil isolated bacteria

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WT02

FLUORESCENCE-ASSISTED EVALUATION OF RHODAMINE B REMOVAL USING PLASMA-ACTIVATED COCONUT COIR BIOCHAR

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Synthetic dyes such as Rhodamine B (RhB) are fluorescent, persistent organic pollutants that resist conventional wastewater treatment and pose serious ecological risks. Therefore, this study aims to develop and evaluate plasma-activated coconut coir biochar (PFBC) as a green and sustainable adsorbent for the efficient removal of RhB from aqueous solutions using spectrofluorometric studies. Fluorescence intensity of RhB was used to quantitatively track dye concentration and evaluate adsorption efficiency, providing a sensitive and direct approach to assess removal dynamics. In this work, coconut coir biochar (CCBC) was synthesized by pyrolysis at 300 °C, 500 °C, and 700 °C, followed by plasma activation using atmospheric air plasma treatment (AAPT) with a double-arc plasma generator under ambient conditions for 30 minutes, offering a scalable and green alternative to conventional vacuum-based systems to obtain PFBC. The pyrolysis temperature of 500 °C was selected as the most suitable condition, yielding a balanced micro-mesoporous structure suitable for dye adsorption. The point of zero charge (pH_{pzc}) values for CCBC and PFBC were determined as 7.3 and 8.1, respectively. Fourier Transform Infrared (FTIR) spectroscopy confirmed the successful introduction of oxygen- and nitrogen-containing surface functionalities, such as hydroxyl, carbonyl, and amine groups, on the PFBC surface following plasma activation. Fluorescence-assisted batch sorption studies confirmed the superior performance of plasma-functionalized PFBC, showing faster uptake and higher RhB removal compared to CCBC. The decrease in fluorescence intensity with time confirmed effective dye adsorption, with optimum performance observed at pH 10 and a contact time of 60 minutes. Kinetic analysis indicated that the adsorption process followed pseudo-second-order behavior, suggesting that the adsorption rate is chemisorption. Equilibrium analysis using non-linear isotherm models showed that adsorption followed the Langmuir model, indicating monolayer adsorption. The maximum monolayer capacity (Q_{max}) increased from 53.9±5.9 mg g^{-1} for CCBC to 82.3±4.0 mg g^{-1} for PFBC at 323 K, corresponding to a 52.7% improvement. Thermodynamic studies revealed negative ΔG values, confirming spontaneous adsorption for both materials. Both adsorbents exhibited positive ΔH values, confirming endothermic behavior, with PFBC (≈18.35 kJ mol^{-1}) showing physisorption driven by electrostatic attraction, hydrogen bonding, and π–π stacking at the optimized alkaline pH, where the negatively charged PFBC surface (above its pH_{pzc}) further enhanced its efficiency. In contrast, CCBC exhibited a higher ΔH (≈36.71 kJ mol^{-1}), indicating a less energy-efficient process. Positive ΔS values reflected increased randomness at the solid–solution interface, while the smaller ΔS for PFBC (≈124.95 J mol^{-1} K^{-1}) suggested more organized, plasma-induced adsorption sites compared to CCBC (≈182.94 J mol^{-1} K^{-1}). Overall, PFBC demonstrated superior adsorption kinetics, capacity, and thermodynamic favorability compared to CCBC. These results establish plasma activation as a green and sustainable modification strategy for developing cost-effective adsorbents for dye-contaminated wastewater remediation.

Keywords: Coconut coir biochar, Plasma activation, Rhodamine B(RhB), Spectrofluorometric evaluation, Sustainable

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WT03

DEVELOPMENT OF PLASMA-FUNCTIONALIZED COCONUT COIR BIOCHAR FOR THE REMOVAL OF AMMONIUM FROM AQUEOUS MEDIA

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Ammonium contamination poses a significant global environmental and public health challenge, stemming from various human activities and waste disposal practices, which lead to eutrophication and toxicity in aquatic systems. Conventional treatment methods often suffer from high costs, complex management, or the risk of secondary pollution, necessitating the development of sustainable and efficient alternatives. Biochar, a cost-effective adsorbent derived from agricultural residues like coconut coir, presents a promising solution; however, its unmodified form often exhibits limited adsorption capacity and surface functionality for effective ammonium removal. This research, therefore, aimed to address these limitations by investigating the development of plasma-functionalized coconut coir biochar (PFBC) for the efficient removal of ammonium ions from aqueous media, specifically focusing on how atmospheric air plasma treatment (AAPT) impacts its physicochemical properties and adsorption performance compared to untreated biochar. The study involved preparing coconut coir biochar (CCBC) at various pyrolysis temperatures (300 °C, 500 °C, and 700 °C) and subsequently treating it with atmospheric air plasma to synthesize PFBC. The biochar produced at 300 °C (300 CCBC) exhibited superior ammonium adsorption capacity (2.5 mg g^{-1} at 300 °C compared to 1.8 mg g^{-1} at 500 °C and 1.1 mg g^{-1} at 700 °C), attributed to the better preservation of vital oxygen-containing functional groups (hydroxyl and carbonyl) at lower pyrolysis temperatures. While plasma activation enhanced microporosity (indicated by higher iodine number) and shifted the Point of Zero Charge (PZC) towards alkalinity, the plasma-treated biochar (300 PFBC) showed lower ammonium adsorption capacity than the untreated 300 CCBC at the optimal pH of 8. This diminished performance was primarily due to the reduction of beneficial hydroxyl functional groups on the 300 PFBC surface (as shown by FTIR) and a less favorable surface charge profile resulting from its higher PZC (8.12 for PFBC vs. 7.29 for 300 CCBC). Prolonged plasma exposure further negatively impacted ammonium uptake capacity. Adsorption behavior for 300 CCBC was best described by the Elovich kinetic model (R^2 = 0.9974) and the Sips isotherm model (R^2 = 0.9950 at 30 °C), indicating heterogeneous chemisorption involving both monolayer and multilayer adsorption. At 30 °C, the maximum adsorption capacity was (14.5±0.9) mg g^{-1}. Thermodynamic analyses confirmed that the adsorption process was spontaneous ($\Delta G°$ from -2 to -13 kJ mol^{-1}), endothermic ($\Delta H°$ of 124 kJ mol^{-1}), and dominated by strong chemical interactions ($\Delta H°$ > 40 kJ mol^{-1} and Dubinin-Radushkevich mean energy of adsorption values > 16 kJ mol^{-1}), with increased spontaneity at higher temperatures. A positive entropy change ($\Delta S°$ of 0.4 kJ mol^{-1} K^{-1}) suggested an increase in randomness at the solid-liquid interface. Post-adsorption FTIR analysis provided direct spectroscopic evidence of the active involvement of surface hydroxyl groups (reduction in the 3350 cm^{-1} peak), carbonyl groups (shift from 1680 cm^{-1} to 1710 cm^{-1}), and the formation of new N-H or C-N bonds (appearance of a peak at 1588 cm^{-1}) in ammonium binding, thus validating the chemisorption mechanism. In conclusion, 300 CCBC is a promising adsorbent for ammonium removal from aqueous systems. AAPT, despite enhancing porosity, proved less favorable for this specific application due to the loss of key functional groups.

Keywords: Ammonium adsorption, Biochar, Plasma functionalization, Wastewater treatment

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WT04

DEVELOPMENT OF PLASMA-FUNCTIONALIZED COCONUT COIR BIOCHAR FOR TARGETED NITRATE REMEDIATION IN AQUEOUS MEDIA

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Nitrate (NO_3^-) is a pervasive water contaminant, primarily arising from anthropogenic activities such as agricultural runoff, fertilizer leaching, wastewater discharge, and various industrial operations. Its excessive presence in aquatic environments drives eutrophication, leading to algal blooms and oxygen depletion, while posing severe risks to human health, including methemoglobinemia, thyroid dysfunction, and the formation of carcinogenic nitrosamines. Regulatory standards, such as the 10 mg L^{-1} nitrate-nitrogen limit established by the U.S. Environmental Protection Agency and the World Health Organization, are frequently exceeded in many regions, emphasizing the need for effective, sustainable, and environmentally friendly remediation strategies. Conventional adsorbents often rely on chemical activation processes that are energy-intensive and involve hazardous reagents or organic solvents, raising environmental and operational concerns. To overcome these limitations, this study introduces a novel, chemical- and solvent-free surface modification technique using atmospheric air plasma treatment (AAPT) for biochar, explicitly applied for the first time in nitrate adsorption. Coconut coir biochar (CCBC) was prepared at pyrolysis temperatures of 300 °C, 500 °C, and 700 °C and subsequently treated with AAPT for 30 minutes to produce plasma-functionalized biochar (PFBC). Temperature optimization revealed that 700 °C yielded the highest nitrate removal efficiency, attributed to the enhanced porous structure and surface functionalities. The point of zero charge (PZC) for CCBC and PFBC was determined to be 7.2 and 8.1, respectively. Fourier transform infrared spectroscopy confirmed the successful incorporation of nitrogen- and oxygen-containing functional groups, including amine, carbonyl, and epoxy moieties onto the PFBC surface. Batch adsorption experiments demonstrated that PFBC significantly outperformed untreated CCBC in nitrate removal at acidic pH values (optimum pH 2), primarily due to the electrostatic interactions facilitated by the newly introduced surface functional groups. Adsorption equilibrium was achieved within 90 minutes, and kinetic analyses using the pseudo-first order, pseudo-second order (PSO), Elovich, and intra-particle diffusion models identified the PSO model as the most suitable (R^2 = 0.9976), indicating that the availability of active sites governs the adsorption rate. Equilibrium adsorption data were further analyzed using Langmuir, Freundlich, Temkin, Sips, and Dubinin–Radushkevich (D–R) isotherm models. The Langmuir model provided the best fit (R^2 = 0.9855), representing monolayer adsorption on homogeneous surfaces and confirming the uniform distribution of active sites on PFBC. A maximum adsorption capacity (Q_m) of 6.4563±0.0250 mg g^{-1} was obtained by the above isotherm. The D-R model revealed a mean adsorption energy (E) of +0.24 kJ mol^{-1}, indicating that physisorption is the dominant mechanism for nitrate uptake by PFBC. Thermodynamic parameters supported the favorable adsorption process, with a positive ΔH (+29.495 kJ mol^{-1}) suggesting an endothermic nature, a positive ΔS (+118.624 J mol^{-1} K^{-1}) reflecting strong biochar-nitrate affinity, and a negative ΔG (-15.020 kJ mol^{-1}) confirming spontaneous adsorption at 50 °C. PFBC prepared via the AAPT method offers sustainable, scalable, and efficient nitrate removal with rapid adsorption, high capacity, and eco-friendly properties for advanced water treatment applications.

Keywords: Coconut coir biochar, Nitrate, Plasma activation, Removal

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WT06

IMMOBILIZATION OF HYDROCARBON-DEGRADING BACTERIAL SPORES IN FLOATING ALGINATE BEADS FOR ENHANCED WASTE OIL REMOVAL FROM AQUATIC ENVIRONMENTS

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Oil contamination in aquatic ecosystems is a critical environmental concern due to the persistence and toxicity of petroleum hydrocarbons. This study focused on isolating hydrocarbon-degrading bacteria from oil-polluted sites in Sri Lanka and developing a stable spore-based formulation for enhanced bioremediation in aquatic environments. Eight morphologically distinct bacterial isolates were obtained from Negombo fishing harbor and vehicle service centers in Kandy, along with a laboratory-maintained strain of *Bacillus cereus*. Crude oil degradation was quantified spectrophotometrically at 400 nm, with residual oil concentrations calculated using a calibration curve ($R^2 = 0.993$). *B. cereus* exhibited the highest degradation efficiency (72.97%), reducing over 50% of crude oil within six days, with an estimated half-life between 4 and 6 days. Sporulation was optimized in nutrient broth, yielding higher biomass (4.26±0.26 g L^{-1}) compared to modified nutrient medium (2.32±0.32 g L^{-1}; $p < 0.01$). A spore weight of 1.433 g corresponded to a concentration of 7.65 log CFU mL^{-1}, which was determined to be optimal for immobilization into beads. Talc-based spore formulations achieved viable counts of 4.5×10^7 CFU mL^{-1} before incorporation and 3.8×10^7 CFU mL^{-1} after incorporation. Floating alginate-carboxymethyl cellulose (CMC) beads were developed for spore immobilization and enhanced buoyancy, using 3.5% sodium alginate and 3.5% CMC for encapsulation, 1.5% $NaHCO_3$ and glacial acetic acid for gas generation, and $CaCl_2$ (0.5-2.0 M) as a cross-linker. Beads formed with 0.5 M $CaCl_2$ demonstrated the highest initial floatation (95.33±0.58)% but reduced stability in seawater, whereas beads with 1.0 M $CaCl_2$ provided optimal buoyancy and durability for extended use. Oil removal trials indicated minimal abiotic degradation (11%), with talc and beads alone adsorbing 56% and 67% of oil, respectively. Biological treatments achieved significantly higher degradation: free cells (69.3%), spores (71.8%), and immobilized spores in alginate-talc beads (76.7%). The superior performance of immobilized spores is attributed to improved stability, extended viability, and combined adsorption-biodegradation effects. This study demonstrates the potential of floating spore-based formulations as an effective and sustainable strategy for mitigating oil pollution in aquatic environments.

Financial assistance from the Centre for Water Quality and Algae Research of the University of the Sri Jayewardenepura is acknowledged.

Keywords: Bacterial spores, *Bacillus cereus,* Biodegradation, Floating alginate-CMC beads, Oil degradation

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WT07

FATE OF ANTIBIOTICS IN HOSPITAL WASTEWATER: VARIABILITY IN TREATMENT EFFICIENCY AND ENVIRONMENTAL RISK IMPLICATIONS

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Hospital wastewater is a major source of antibiotic residues, posing significant risks to aquatic ecosystems and contributing to the development of antimicrobial resistance. This study evaluated the removal efficiencies of selected antibiotics in wastewater treatment plants serving 17 hospitals in Sri Lanka. The antibiotics monitored included tetracycline (TET), ampicillin (AMP), amoxicillin (AMX), sulfamethoxazole (SMX), sulfadiazine (SDI), and erythromycin (ERM). Results demonstrated variable removal efficiencies across different antibiotic classes. TET, SDI, SMX, and ERM showed reductions exceeding 60% in hospital effluents before discharge into the environment. Overall, the removal efficiency for the entire treatment process ranged from 50-100% for TET, 40-54% for AMP, 35-58% for AMX, 52-72% for SMX, 63-72% for SDI, and 63-72% for ERM. The comparative efficiency varied as tetracyclines > sulfonamides > macrolides > penicillins. Despite these reductions, residual concentrations of AMX, AMP, ERM, and SMX remained considerably high in treated effluents, whereas TET and oxytetracycline were found at relatively lower levels. Notably, none of the antibiotics were completely removed during the physical treatment process. The persistence of certain compounds highlights the limitations of conventional hospital wastewater treatment systems and their inability to fully eliminate pharmaceutical contaminants. These findings emphasize the need for advanced treatment technologies and improved wastewater management strategies to mitigate the release of antibiotics into aquatic ecosystems and reduce the potential spread of antimicrobial resistance.

Keywords: Amoxicillin, Hospital effluent, Sulfamethoxazole, Tetracycline

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WT08

DEVELOPMENT OF NITRIFYING AND DENITRIFYING BACTERIA IMMOBILIZED CELLULOSE NANOCRYSTAL-BASED BIOFILTER TO TREAT AQUARIUM WASTEWATER

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The discharge of nitrogen-rich effluents from aquarium systems poses a significant environmental threat, necessitating cost-effective and sustainable treatment methods. This study developed a biofilter utilizing Cellulose Nano Crystals (CNCs) as a bacteria-immobilizing matrix to enhance the removal of Ammonia, Nitrite, and Nitrate from aquarium wastewater. Cellulose was chemically extracted from the invasive aquatic plant *Salvinia* spp. collected from Boralesgamuwa Lake, yielding 36.7% cellulose. CNCs were synthesized via acid hydrolysis and characterized using Fourier transform infrared spectroscopy and dynamic light scattering. Nitrifying and denitrifying bacteria were isolated from aquarium wastewater using traditional plating techniques and immobilized on CNCs through chemically induced embedding techniques. A prototype biofilter was constructed by layering bacteria-immobilized CNCs on polyester sponge and activated carbon. Control filters were developed separately to evaluate the ammonia, nitrite, and nitrate removal efficiencies of polyester sponges, activated carbon layer, and bacteria-free CNCs. Experimental setups and control setups were operated under similar conditions, maintaining a flow rate of 1.840-1.876 L min^{-1} and a hydraulic retention time of 12.31-12.55 seconds. Over 16 days, the experimental biofilter achieved removal efficiencies of 56.5% (ammonia), 42.5% (nitrite), and 33.2% (nitrate), significantly outperforming the control setups. These findings demonstrate the potential of CNC-based bacterial immobilization as an effective, low-cost, and eco-friendly strategy for treating nitrogen-rich wastewater, offering a promising solution for sustainable aquarium and aquaculture system management.

Financial assistance from the Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, is acknowledged.

Keywords: Biofilter, Cellulose nanocrystals, Denitrifying bacteria, *Salvinia* spp., Nitrifying bacteria, Wastewater

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WT10

REMOVAL OF LEAD(II) FROM CONTAMINATED WATER BY RAW AND BIOCHAR OF *Panicum maximum*

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Lead (Pb) contamination in aquatic environments, mainly due to industrial effluents, remains a pressing environmental and public health concern because of its persistence, bioaccumulation, and toxicity, requiring attention on effective Pb removal from contaminated water. Although *Panicum maximum* has been reported for the accumulation of heavy metals from soil, its ability to adsorb heavy metals from contaminated water has not been extensively explored. The aim of this study was therefore to investigate the potential use of raw *Panicum maximum* plant fibers (PMF) having a cosmopolitan distribution and its biochar, as low-cost biosorbents for the adsorption of Pb(II) from aqueous solution. *Panicum maximum* is widely used as animal forage; but a significant economic value has not been identified. X-ray fluorescence spectroscopic analysis confirms the biosorption of Pb(II) on the fibers with the appearance of a high intense peak responsible for Pb after adsorption, while the Fourier transform infrared spectroscopy results in a sharp band responsible for Pb-O bond stretching vibration at 448 cm^{-1} and 467 cm^{-1}after adsorption of Pb(II) on raw and biochar of PMF, respectively. This observation together with shifting in C=O (ester) bands at 1735 cm^{-1} to a lower wavenumber further confirms the adsorption of Pb(II) by both biosorbents. Parameter optimization conducted for the adsorption of Pb(II) on both biosorbents using 10 mg L^{-1} Pb(II) solutions at ambient temperature by varying the biosorbent dosage, shaking time, settling time and pH (1.00-7.00), lead to optimum values of 0.1000 g biosorbent dosage, 20 min shaking time, 20 min settling time and pH of 6.89 (ambient pH), resulting in removal of 94.9% and 91.9% for raw and biochar of PMF, respectively. Moreover, both biosorbents demonstrate the validity of pseudo-first order kinetics with regression coefficients of 0.9971 and 0.9735, with rate constants of 1.64×10^{-1} min^{-1} and 6.81×10^{-2} min^{-1} for raw and biochar of PMF, respectively. These findings indicate that the raw biosorbent is more effective than biochar for the adsorption of Pb(II), probably due to complexation of Pb(II) with functional groups such as C=O (ester), some of which would be lost during the production of biochar.

Keywords: Biosorption, Kinetics, Optimization, *Panicum maximum,* Pb(II) ions

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WT11

COMPARATIVE STUDY OF REMOVAL OF Ni(II) FROM CONTAMINATED SOLUTIONS USING TEA WASTE DERIVED BIOCHAR

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Nickel contamination in aquatic environments is a leading environmental concern in recent decades due to its toxicity, non-biodegradability, and ability to bioaccumulate, causing severe health issues in humans. Electroplating, combustion of fossil fuels, battery manufacturing, corrosion, and leaching are some sources of nickel. Conventional wastewater treatment methods, such as chemical precipitation, membrane filtration, and ion exchange, are expensive and generate secondary waste. To overcome these drawbacks, biosorption, which is cost-effective and eco-friendly, has been employed. In situations of low adsorption capacity of biosorbents, modification using chemical or thermal treatments, which lead to more active adsorption sites, can be implemented. In this study, factory tea waste, which is abundant, was used for the production of biochar to remove Ni(II) from contaminated water. Two different types of biochar were prepared: unmodified biochar produced by pyrolyzing tea waste at 400 °C for 1.0 h (UTWB), and NaOH-modified biochar prepared by pyrolyzing tea waste at 300 °C for 1.0 h, followed by chemical treatment with 0.10 mol L^{-1} NaOH (STWB). At 400 °C, biochar exhibits a higher mass loss (27%) compared to the biochar produced at 300 °C (11%). This difference suggests that STWB offers better yield and potentially greater structural stability. Batch adsorption experiments carried out to optimize operational parameters indicate that the optimum dosage of STWB is 0.30 g at an optimum shaking time of 20 min, while these parameters for UTWB are 0.60 g at 20 min, respectively. Further, settling time does not affect the removal efficiency by both STWB and UTWB. At the optimized conditions, both types of biochar achieve a removal efficiency of 98%. Suspensions of Ni(II) solutions of 10 mg L^{-1} and 25 mg L^{-1} with both types of biochar attain equilibrium so fast that investigation of kinetics is not feasible within the normal time scale. Pyrolysis and the modification enhance the porous structure of the biochar surface, facilitating metal ion binding with a high adsorption capacity. Overall, this study highlights that tea waste-derived biochar is a viable, eco-friendly, and low-cost adsorbent for the remediation of Ni(II) from contaminated water. The findings indicate that NaOH modification of lower-temperature biochar can reduce the energy and improve the yield with equivalent removal efficiency compared to UTWB, confirming a better option for large-scale wastewater treatment.

Keywords: Adsorption, Biochar, Tea waste, Dosage, Ni(II) remediation

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WT12

REMOVAL OF Cr(VI) FROM WASTEWATER USING ACETIC ACID MODIFIED *Eichhornia crassipes* BIOSORBENT

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Industrial wastewater, which frequently contains toxic heavy metals in different oxidation states, is a major contributor to environmental pollution. Hexavalent chromium [Cr(VI)] is one such heavy metal that poses several environmental and health risks due to its high toxicity and persistence. Existing methods for the removal of Cr(VI) are costly and generate secondary pollution, highlighting the need for low-cost and eco-friendly alternatives. Biosorbents are widely used to remove heavy metals from contaminated wastewater. Investigating the potential of *Eichhornia crassipes* biomass, chemically modified with acetic acid, as a low-cost, sustainable, and eco-friendly biosorbent for the removal of Cr(VI) from aqueous solution was the main objective of this study. The biosorbent modified by treatment with 0.1 mol L^{-1} acetic acid for 1.0 h at ambient temperature leads to optimum parameters of 2.0 g biosorbent dosage over a pH range from 4.0 to 6.0 for adsorption of Cr(VI) from 50.0 mL of 10 mg L^{-1} Cr(VI) solution according to atomic absorption spectrophotometric (AAS) measurements, performed in triplicate. Fourier transform infrared spectroscopy indicates the changes in band position of -COOH and -OH functional groups upon acetic acid modification, while a new peak for Cr appears in the X-ray fluorescence spectrum after treatment of biosorbents with Cr(VI) solution, confirming the adsorption of Cr. The levels of residual Cr(VI) in solution after interaction with the biosorbent, as determined by AAS, indicate that modification of *Eichhornia crassipes* with acetic acid significantly enhances its biosorption capacity, achieving optimal removal efficiency. The most striking feature is that the low extent of removal of less than 10% for Cr(VI) by raw biosorbent is significantly enhanced to 89% and 95%, respectively, under optimized conditions by modified leaf and root particles of the biosorbent. The marked improvement of the performance of acetic acid-modified *Eichhornia crassipes* biosorbent is attributed to increased positively charged binding sites on the biosorbent surface, which would attract negatively charged Cr(VI) through electrostatic attractions. These findings highlight the potential of employing acetic acid-modified biosorbent as an effective and sustainable means for Cr(VI) remediation, with possible applicability in wastewater treatment systems.

Keywords: *Eichhornia crassipes*, Biosorbent, Cr(VI), Heavy metal, Wastewater

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WT13

COMPARATIVE ADSORPTION EFFICIENCY OF NATIVE CELLULOSE AND CELLULOSE NANOPARTICLES EXTRACTED FROM *Panicum maximum* FOR METHYLENE BLUE REMOVAL FROM AQUEOUS SOLUTIONS

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The removal of synthetic dyes from industrial effluents remains a pressing environmental challenge due to their toxicity, persistence, and resistance to biodegradation. Methylene blue (MB), a widely utilized cationic dye in the textile, paper, and leather industries, is noted for its detrimental ecological and health effects. Sustainable and low-cost adsorbents derived from renewable biomass offer eco-friendly alternatives to expensive physicochemical methods for dye remediation. This study focuses on the comparative evaluation of MB adsorption efficiency using native cellulose (NC) and cellulose nanoparticles (CNPs) extracted from *Panicum maximum*, an invasive tropical grass with high cellulose content and wide availability. NC was isolated from *Panicum maximum* through alkali and bleaching treatments, while CNPs were obtained via controlled acid hydrolysis. Comprehensive characterization of both adsorbents for their surface functional groups and surface characteristics was performed using Fourier transform infrared spectroscopy, X-ray diffraction, and scanning electron microscopy. NC is found to exhibit a limited surface area and moderate crystallinity, whereas the CNPs possess uniform nanoscale dimensions with significantly higher surface area. These differences suggest enhanced potential of CNPs for dye adsorption through electrostatic interactions and hydrogen bonding. Dosage optimizing experiments performed, using a series of different dosages (4 mg, 10 mg, 15 mg, 20 mg, 25 mg, 30 mg, 40 mg, 50 mg, 60 mg), on NC indicate that 40 mg is the optimum dosage for 5 mg L^{-1} MB solution leading to 72% removal, while CNPs lead to a much higher removal of 90% for 10 mg L^{-1} MB solution. These results indicate that CNPs exhibited substantially higher removal efficiency than NC under identical conditions, attributable to their enhanced surface reactivity and nanoscale structure. Overall, this comparative study highlights the superior performance of CNPs extracted from *Panicum maximum* in removing MB from aqueous solutions compared to NC. The findings underscore the value of nanoscale modification in enhancing the adsorption capacity of lignocellulosic biomass and contribute to the development of sustainable, biodegradable, and cost-effective adsorbents for wastewater treatment. Furthermore, the study establishes *Panicum maximum* as a promising non-woody biomass resource for producing functional nanocellulose adsorbents, thereby supporting circular economy strategies and mitigating environmental pollution caused by synthetic dyes. Batch adsorption experiments are being conducted to investigate the effects of contact time, pH, initial MB concentration, and reaction kinetics.

Keywords: Adsorption, Cellulose nanoparticles (CNPs), Methylene blue (MB), Native cellulose (NC), *Panicum maximum*

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WT14

ANODIC STRIPPING VOLTAMMETRIC ANALYSIS OF As(III) AND As(V) IN WATER USING A GOLD-MODIFIED CARBON FIBER MICROELECTRODE

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Arsenic (As) contamination is one of the most significant challenges in providing safe drinking water worldwide. Both As(III) and As(V) are highly toxic; however, As(III) presents a severe health threat, even at trace concentrations, and has been associated with cancers, cardiovascular complications, and neurological disorders. Several studies have claimed that prolonged arsenic exposure may significantly contribute to the increasing incidence of chronic kidney disease of unknown etiology (CKDu) in Sri Lanka and other parts of Asia. Therefore, regular monitoring of arsenic in drinking water is essential. However, widely used laboratory methods such as atomic absorption spectroscopy and inductively coupled plasma mass spectrometry (ICP-MS) are generally expensive, require specialized facilities, and are unsuitable for on-site analysis and arsenic speciation. However, electrochemical analysis, integrated with microelectrodes, offers high sensitivity, rapid response, and potential for portability, providing a promising alternative for real-time water testing. In this study, a carbon fiber microelectrode (CFME) was fabricated by sealing a carbon fiber into a glass capillary and polishing it to expose a clean surface. Cyclic voltammetry confirmed proper electrode function with a limiting current of 6.45 nA, matching the expected microelectrode size. Sensitivity was enhanced by electrodepositing gold nanoparticles within +1.5 V to -0.5 V, with 15 deposition cycles yielding the most stable surface and strongest arsenic response. The modified CFME was first applied to arsenic (III) detection using anodic stripping voltammetry (ASV). The best performance was obtained at a deposition potential of -0.5 V with a deposition time of 600 s. Under these conditions, the calibration curve showed an excellent linearity (R^2 = 0.99), and the detection limit was below 10 nM, highlighting the high sensitivity of the electrode toward trace levels of As(III). As(V) detection was performed using anodic stripping voltammetry at an optimized deposition potential of -0.7 V and a deposition time of 420 s. The calibration curve showed good linearity (R^2 = 0.91). The gold-modified CFME exhibited stable and reproducible responses, with 15 deposition cycles identified as optimal for As(V) detection. These findings demonstrate that a carbon fiber microelectrode modified with gold nanoparticles provides a reliable, sensitive, and selective platform for detecting both As(III) and As(V) in aqueous environments. The ability to achieve nanomolar detection limits with a low-cost, miniaturized electrode highlights the strong potential of this approach for portable arsenic sensors. With further development, including integration into handheld analytical devices, this method could offer a practical solution for routine water monitoring, particularly in regions where arsenic contamination and CKDu remain pressing public health concerns.

Keywords: Arsenic (III), Arsenic(V), Carbon fiber microelectrode, Gold nanoparticles, Water quality

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WT15

ISOTHERM MODELS FOR THE ADSORPTION OF ANIONIC SURFACTANT, SODIUM DODECYL SULFATE, ON FIRED BRICK CLAY

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Water contamination by surfactants is a serious environmental and health issue, making their removal from water sources a priority. Among many other available methods, adsorption is a well-established, versatile method for the removal of pollutants, although it has not been much used for the removal of surfactants, especially using natural adsorbents. In this study, brick clay was explored as a natural adsorbent for removing sodium dodecyl sulfate (SDS), an anionic surfactant, from synthetic industrial wastewater. Under optimum conditions of 400 ºC firing temperature, 1.5 h shaking time, 0.5 h settling time, 80 g L^{-1} adsorbent dosage, and pH of 2.0, fired brick clay particles achieve an impressive extent of removal of 99%. The approach of an adsorbate to the fired brick clay surface is not simple because it involves many mass transfer steps, namely bulk transport, film diffusion, intra-particle diffusion, and adsorption, all of which would contribute to the adsorption process. Such studies are limited, and hence, this study is mainly on applying the Langmuir, Freundlich, Temkin, Redlich-Peterson, and Dubinin-Radushkevich (D-R) adsorption isotherm models to investigate mass transfer of SDS on fired brick clay particles under optimum conditions. Brick clay fired at 400 ºC fulfills the requirements of the Langmuir adsorption isotherm with a higher regression coefficient of 0.997, indicating monolayer adsorption through chemisorption. The Langmuir constant is determined to be 1.20×10^{-3} L mg^{-1}, indicating that the adsorption process is favorable and that adsorbate molecules are held tightly to the surface of the adsorbent. Further, the adsorption of SDS follows the Temkin adsorption isotherm model as well, with a higher regression coefficient of 0.995, indicating that adsorption is driven by either repulsive interactions between adsorbate molecules or a uniformly heterogeneous surface with linearly distributed binding energies. Moreover, the requirements of the Freundlich adsorption isotherm and the D-R isotherm model are not fulfilled as per the lower regression coefficients. This study provides useful information for the design of large-scale water treatment systems for the removal of anionic surfactants.

Keywords: Adsorption, Brick clay, Equilibrium, Isotherms

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WT16

CHITOSAN MICROBEADS FOR THE ADSORPTIVE REMOVAL OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTIONS

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Water pollution from organic dyes has become one of the main environmental issues worldwide. Out of many techniques to remove toxic organic dyes from aqueous solutions, adsorption stands out due to various advantages such as low cost, ease of operation, and availability of diverse adsorbents. However, most synthetic adsorbents involve complex synthesis, high manufacturing cost, and show limitations in regeneration and disposal. Therefore, this study focused on the synthesis and characterization of microbeads from chitosan for the removal of methylene blue from aqueous solutions. Chitosan microbeads were prepared through the ionotropic gelation method by adding chitosan solution, which was prepared by dissolving chitosan in 1% acetic acid solution dropwise into a 2 M NaOH solution. Microbeads were characterized using Fourier transform infrared (FTIR) spectroscopy and optical microscopic studies. Batch adsorption experiments were carried out to optimize the parameters for the adsorption of methylene blue on the prepared chitosan microbeads. The remaining dye concentrations after the adsorption were measured using UV-Vis spectrophotometry. The dye concentration, pH, shaking time, settling time, and dosage were systematically optimized. The optimized parameters for methylene blue adsorption on chitosan microbeads were 10 mg L^{-1} of dye concentration, pH of 6.0, 60.0 min of shaking time, 3.0 min of settling time, and 0.060 g of dosage. The total percentage of dye removal with chitosan-based microbeads was 52.67%. The data fit well with the pseudo-second order kinetic model, indicating that the rate-determining step is chemisorption. The findings demonstrate that chitosan is an effective material for microbead synthesis and exhibits potential as an adsorbent for the removal of methylene blue from aqueous solutions.

Keywords: Adsorption, Chitosan, Kinetic model, Methylene blue, Microbeads

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WT17

REMOVAL OF METHYLENE BLUE FROM AQUEOUS SOLUTIONS USING NUTMEG SEED SHELL: A SUSTAINABLE APPROACH

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Release of industrial dyes into wastewater leads to increased levels of environmental pollution, an ever-expanding global issue. Among numerous types of dyes available, methylene blue (MB), a commonly used dye in the textile industry as well as in medicinal applications, is toxic, carcinogenic, and non-biodegradable. As industrial sectors expand, increased dye disposal threatens the environment, prompting the development of suitable techniques for their removal from wastewater. Biosorption has become superior to many other methods in removing pollutants from industrial wastewater, owing to the large number of pore sites available, and being natural and biodegradable. In this context, this study investigated the potential of nutmeg seed shells (NSS), a readily available agricultural byproduct, for the removal of MB from contaminated wastewater. Fourier transform infrared spectroscopic investigation of the dried NSS indicates the presence of O-H or N-H, C=O, and C-O as functional groups. Batch studies conducted on NSS using MB solution of 10.0 mg L^{-1} lead to the optimum values of 0.150 g dosage (range: 0.001-0.400 g), 30.0 min shaking time (range: 5-90 min) and 60.0 min settling time (range: 5-90 min) at which the average extent of removal of MB is determined to be above 97.0%, based on UV-Vis spectrophotometric measurements at 662 nm. Adsorption of MB on NSS follows pseudo-first order kinetics, before the equilibrium is established, with a high correlation coefficient of $R^2 = 0.9639$. This study shows that the NSS would have the potential to be used as an effective and environmentally friendly biosorbent to remove MB from contaminated solutions, releasing treated contaminated water to the environment. To effectively assess the suitability of this biosorbent for industrial applications, it is essential to scale up experiments and rigorously evaluate the quality of treated water.

Keywords: Adsorption, Biosorbent, Methylene blue, Nutmeg seed shell, Wastewater

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WT18

ARECANUT HUSK FIBERS AS A SUSTAINABLE BIOSORBENT FOR Ni(II) REMEDIATION

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Heavy metal-induced water pollution has been a pressing issue with the rapid industrial growth. Although it is a micronutrient for plants and some organisms, excess Ni(II) exposure leads to the deterioration of ecosystems. Thus, pollution of water bodies due to Ni(II) poses a threat to humans and the environment. Even though many heavy metal remediation methods are in practice, they are associated with high costs and secondary pollutants being generated. It is thus necessary to explore alternative, cost-effective heavy metal removal methods for sustainable development. Biosorption can be considered as one of the best alternatives in this respect. This study investigates the use of Arecanut husk fibers for Ni(II) removal from aqueous solutions. Manually extracted fibers were cut into 0.5 cm pieces in length, oven dried at 60 °C for 6.0 h, followed by thorough rinsing with deionized water for all experiments. Both X-ray fluorescence spectroscopy and scanning electron microscopy confirm the adsorption Ni(II) by the biosorbent, while Fourier transform infrared spectroscopy suggests the functional groups present on the biosorbent surface. Optimization of experimental parameters, carried out keeping all the parameters constant but varying one parameter at a time in a broad range, concludes the optimum values of 1.00 g biosorbent dosage, 40.0 min shaking time, and 15.0 min settling time, at the ambient pH of 5.58, ambient temperature of 25°C and 150 rpm agitation speed. Under these conditions, 92.99% removal of Ni(II) is determined from 10.0 mg L^{-1} Ni(II) solution. Kinetics studies depict the pseudo-second order (PSO) model as the best fit, with a high regression coefficient of 0.9989, implying that the adsorption process is controlled by two distinct types of functionalities present on the adsorbent surface. Adsorption rate constant calculated as per the PSO model is 8.87×10^{-4} kg mg^{-1} min^{-1} at ambient pH. The Webber-Morris plot of the amount of Ni(II) adsorbed vs. $t^{1/2}$ with a nonzero intercept implies that both intraparticle diffusion and boundary layer affect the adsorption rate. Surface modification of Arecanut husk fibers using aqueous NaOH solution is proven to be more effective for Ni(II) removal than raw fibers. The next logical step of this study is the extension for mass-scale Ni(II) removal from wastewater.

Keywords: Biosorption, Chemisorption, Heavy metal-induced water pollution, Pseudo-second order model, Sustainable development

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WT19

POTENTIAL APPLICATION OF RED EARTH AND LATERITE TO REMOVE SULFAMETHOXAZOLE ANTIBIOTIC IN AQUEOUS MEDIA

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Sulfamethoxazole (SMX) is one of the commonly used antibiotics in veterinary and human medicine. Its wide applications lead to their accumulation in aqueous media (usually ng L^{-1} to μg L^{-1} scale). It has a long persistence time and high resistance to natural biodegradation compared to other commonly used antibiotics, which may pose a threat to humans and animals by promoting antibiotic-resistant bacteria. Previous studies have reported that both Laterite (LT) and Red Earth (RE), which are natural soils rich in Fe and Al oxides, can effectively remove certain antibiotics (Ciprofloxacin, Tetracycline). However, the application of these soils for the removal of SMX has not yet been evaluated. Hence, this study aims to analyze the removal efficiency of SMX from aqueous media using both RE and LT. A series of batch adsorption experiments was performed to evaluate the optimum conditions for effective removal of SMX by both LT and RE (< 1 mm). The effect of initial adsorbate concentration (15 mg L^{-1}, 25 mg L^{-1} and 50 mg L^{-1}), contact time (5 min, 10 min, 30 min, 60 min, and 120 min), adsorbent dosage (0.1 g, 0.5 g, and 1 g), and pH (3, 5, 7, 9, 11) were evaluated. All samples were filtered using 45 μm filters, and the SMX concentrations were measured using a UV spectrophotometer at 266.1 nm (λ_{max}). All experiments were triplicate. RE and LT exhibited the maximum removal of 28.2% and 20.2%, respectively, for a 15 mg L^{-1} SMX solution, with 50 g L^{-1} dosage, at pH 5 and 120 min contact time. The adsorption mechanism best fits with the Langmuir model for both RE and LT (R^2 = 0.9523 for RE and R^2 = 0.9402 for LT), indicating the monolayer adsorption with the maximum adsorption capacity of 0.1701 mg g^{-1} for RE and 0.042 mg g^{-1} for LT. The adsorption data of both soils followed the pseudo-second order kinetic model, implying the rate-limiting step of the adsorption mechanism is chemisorption. The relatively low removal efficiency of SMX compared to other antibiotics suggests that the raw forms of RE and LT are insufficient for its effective removal, highlighting the need for modifications or integrated treatment approaches.

Keywords: Adsorption, Laterite, Red earth, Sulfamethoxazole, Water purification

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WT20

INVESTIGATION OF RAW BAMBOO AS A LOW-COST, ECO-FRIENDLY ADSORBENT FOR CATIONIC DYE REMOVAL IN WASTEWATER

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Bamboo, a renewable and widely available biomass, has been increasingly explored as a sustainable adsorbent for wastewater treatment. However, its performance varies depending on pollutant type and preparation method. In this study, raw bamboo leaves were directly utilized as a low-cost adsorbent to investigate their capability for selective dye removal from aqueous solutions. The adsorbent was prepared by drying, grinding, and sieving bamboo leaves. Scanning electron microscopy of the adsorbent shows a porous surface favorable for adsorption, while Fourier transform infrared spectroscopy confirms the involvement of functional groups present in the adsorbent in binding. X-ray fluorescence spectroscopy detects native minerals such as calcium, while X-ray diffraction indicates a low-crystallinity amorphous structure typical of lignocellulosic biomass. The surface area of the adsorbent is determined to be 9.30 $m^2 g^{-1}$. Batch adsorption experiments were carried out at ambient temperature within a pH range of 6.8-7.2. Adsorption experiments conducted on the removal of methylene blue (MB, a cationic dye) and Congo red (CR, an anionic dye) lead to the optimum values of 0.25 g dosage, 1.0 h shaking, 1.0 h settling, and 20 mg L^{-1} initial dye concentration, at which over 94.88% removal is achieved for MB, while it is 1.23% for CR. The high removal efficiency toward MB is attributed to strong electrostatic attraction between the negatively charged bamboo surface and the cationic MB molecules, while electrostatic repulsion occurs between the negatively charged adsorbent surface and the anionic dye. The results highlight that raw bamboo leaves exhibit remarkable efficiency for MB removal, even without chemical modification, although not suitable for anionic dye removal. Overall, the study demonstrates the potential of raw bamboo leaves as a cost-effective, eco-friendly adsorbent for selective dye remediation, while emphasizing the need for modifications to remove anionic dyes and to expand their applicability in multifunctional wastewater treatment systems.

Keywords: Adsorbent, Bamboo, Congo red, Methylene blue

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HUMAN HEALTH

HH01

ASSESSMENT OF ANTIBIOTIC RESISTANCE IN FRESH WATER ORNAMENTAL FISH FARMS: IMPLICATIONS FOR HUMAN AND ECOSYSTEM HEALTH

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Bacterial diseases pose a significant problem in the ornamental fish farm industry, causing mortality, financial loss, and impairment to fish quality. Therefore, freshwater ornamental fish farms heavily and continuously rely on antibiotics, which contribute to the development of antibiotic-resistant bacteria (ARB). The discharge of ARB with effluent water from ornamental fish farms represents a major pathway for environmental contamination with implications for public health and environmental health, as they persist and transfer resistance genes to other bacteria in the ecosystem. This study assessed the prevalence of ARB in wastewater from 25 ornamental fish farms in Sri Lanka's Western Province, representing various operational scales: display/shell, small, medium, large, and export-oriented farms. From each location, three samples were collected, and only morphologically different bacterial colonies were isolated using the standard pour plate method with medium spiked with Amoxicillin (AMX), Cloxacillin (CLOX), Tetracycline (TET), Oxytetracycline (OTC), Erythromycin (ERY), and Ampicillin (AMP). Minimum Inhibitory Concentrations (MICs) were determined using the agar dilution method. Total Viable Count (TVC)values ranged up to 7.16×10^3 CFU mL^{-1}, with medium-scale farms indicating the highest TVC. Resistance levels towards each antibiotic varied as TET (81%) > AMX (60%) > AMP (51%) > OTC (50%) > CLOX (45%) > ERY (30%). Resistance levels correlated with farm scale, and medium (29%), large (16%), and export farms (19%) had the highest resistance levels towards TET, while display/shell farms had the highest level of resistance to AMP (18%) and AMX (13%). The majority of isolates demonstrated high MIC concentration (420 < μg mL^{-1}), with 60% isolates for AMP, 58% for TET and ERY, 56% for CLOX, and 55% isolates for AMX. Moderate resistance levels (180-300 μg mL^{-1}) were observed in all antibiotics tested. This study revealed that ornamental fish farm effluent contains ARB, which could pose serious threats to ecosystem integrity and human health. Given the potential for environmental dissemination of resistant pathogens from wastewater effluents, implementations are required, including communicating the need for antibiotic stewardship programs to be applied and for existing monitoring programs regarding human and environmental health to be enhanced.

Keywords: Antibiotic resistance, Antibiotic-resistant bacteria, Minimum inhibitory concentration, Ornamental fish farms

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HH02

ASSESSMENT OF THE CORRELATION BETWEEN GROUNDWATER QUALITY AND CKDu IN MEDAWACHCHIYA, SRI LANKA

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Chronic Kidney Disease of unknown etiology (CKDu) refers to a chronic kidney condition with no clearly identified cause yet. It has been an increasing health concern in Sri Lanka over the past few decades, especially in the North-Central Province and its surrounding areas. According to the currently available data, the number of patients is significantly high in the Medawachchiya region in the Anuradhapura District. Therefore, Medawachchiya was selected as the study site. CKDu may be associated with multiple causative factors such as toxic metals, water contaminants, heat stress, dehydration, and pesticide exposure. The aim of this study was to examine the correlation between drinking water and CKDu in the Medawachchiya region. To identify the relationship between groundwater and CKDu, 56 water samples were collected from 23 sampling sites in the Medawachchiya region. The samples included 22 dug well samples, 14 tube well samples, 11 surface water (reservoirs) samples, and 9 RO (Reverse Osmosis) water samples. Water quality parameters, including TDS (Total Dissolved Solids), pH, EC (Electrical Conductivity), alkalinity, hardness, major cations (K^+, Mg^{2+}, Ca^{2+}, Na^+), major anions (NO_3^-, F^-, Cl^-, PO_4^{3-}, SO_4^{2-}), and trace metals (Ni, Cd, Cr, Zn, Cu), were measured to assess the geochemical relationship between water quality and CKDu in the area. The groundwater samples had a pH range from 6.83-8.48, indicating that some water samples were slightly acidic. Electrical conductivity ranged from 152-2034 $\mu S\ cm^{-1}$, and TDS levels ranged from 1.04×10^{-6}-994.5 mg L^{-1}. Most of the samples had values higher than the desirable levels. The maximum concentrations of major cations were observed in the following order: $Na^+ > Mg^{2+} > Ca^{2+} > K^+$. An important observation was that the abundance of alkali metals (Na^+ and K^+) exceeded that of alkaline earth metals (Ca^{2+} and Mg^{2+}). The maximum concentrations of anions followed this order: $HCO_3^- > Cl^- > SO_4^{2-} > F^- > PO_4^{3-} > NO_3^-$. This indicates that the concentration of the weak acid (HCO_3^-) was higher than that of the strong acids (Cl^-, SO_4^{2-}, and NO_3^-). A one-way ANOVA ($p < 0.005$) was used to compare the means of three groups (dug well, tube well, and reservoirs) to determine whether there were statistically significant differences among them. Significant differences between the means were identified in calcium, fluoride, sulphate, and nitrate.

Keywords: CKDu, Groundwater quality, Medawachchiya

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HH03

RELATIONSHIP OF WATER IONICITY WITH THE PREVALENCE OF CKDu IN MONARAGALA DISTRICT, SRI LANKA

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Water quality has declined in almost all agricultural regions around the world. Chronic Kidney Disease of unknown etiology (CKDu) is one of the major health issues that most farming communities in Sri Lanka's rural dry zone have met with over the last two decades. Though many scientists have proposed a variety of risk factors, the primary factor for CKDu is still unknown. However, CKDu has a strong relationship with some aspects of water quality. The prime objective of this research was to assess the water quality of the Monaragala District in the Uva Province of Sri Lanka, where agriculture is the main source of income for the rural people, with regard to CKDu. A total of 74 water samples were collected, comprising groundwater sources (dug wells and tube wells), surface water sources (reservoirs, rivers, and tanks), and Reverse Osmosis (RO) water. Samples were analyzed for water quality parameters, including pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), total alkalinity, major cations and anions, and selected heavy metals, to compare water quality standards. Results showed that more than 70% of the water samples collected in the Monaragala district are alkaline. The order of anion concentrations in the water samples was HCO_3^- > Cl^- > SO_4^{2-} > F^-. For cations, the concentration order in dug well and tube well samples was Ca > Na > Mg > K, whereas in surface water and RO water it was Ca > Na > K > Mg. Statistically, groundwater, surface water, and RO water showed a significant difference for pH, EC, TDS, hardness, alkalinity, and F^- ($p < 0.005$). Statistical analysis and the spatial distribution of CKDu inferred that water quality has a significant impact on CKDu prevalence in the Monaragala District.

Keywords: CKDu, GIS, Monaragala, Spatial distribution, Water quality

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HH04

SYNERGISTIC EFFECT OF FLUORIDE AND HARDNESS OF DRINKING WATER ON NEPHROTOXICITY: MORPHOLOGICAL OBSERVATIONS OF PHASE CONTRAST AND FLUORESCENT MICROSCOPY USING VERO KIDNEY CELL LINE

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Chronic Kidney Disease of unknown etiology (CKDu) is a growing health crisis in Sri Lanka, predominantly affecting farming communities in the North-Central and Uva provinces. The exact cause remains unclear, but increasing evidence from previous literature points to a combination of environmental factors, including high fluoride concentrations and water hardness in drinking water. Fluoride and hardness are suspected to exert nephrotoxic effects, potentially through synergistic interactions that damage renal tissue over time. The present study focused on determining the synergistic effect of fluoride and hardness in drinking water on nephrotoxicity, based on morphological changes observed in Vero kidney cells using phase-contrast and fluorescence microscopy. Vero cells were cultured in 24-well plates at 5×10^4 cells mL^{-1} for 24 hours at 37 ºC, 5% CO_2 with an appropriate humidity to allow cell attachment. Once the cells reached their optimal cell growth, the cells were treated with different concentrations of fluoride alone (0.5, 2.5, 5.0, 7.5, 10.0, 12.5 and 15 mg L^{-1}), hardness alone (60, 100, 200, 400, 600, 800 and 1000 mg L^{-1}) and combinations of fluoride: hardness (0.5: 60, 2.5:100, 5.0: 200, 7.5: 400, 10.0: 600, 12.5: 800 and 15: 1000 mg L^{-1}) for 24 hours to induce apoptosis. The cells were exposed to distilled water for 24 hours as the control. Then the treated cells were observed for morphological changes under a phase-contrast microscope. Acridine Orange/Ethidium Bromide double staining was done for the fluorescence microscopy. The treated cells were stained, and the stained cells were observed for morphological changes under a fluorescence microscope using blue filters. Triplicate experiments were carried out for each concentration for the assay. According to phase-contrast microscopy observations, the confluence was decreased in cells exposed to the fluoride and hardness ratios than in the cells exposed to fluoride and hardness alone, confirming greater cytotoxicity in fluoride and hardness combinations. The fluorescence microscopy confirmed the apoptotic effects in Vero cells exposed to fluoride and hardness ratios than the cells exposed to fluoride and hardness alone. Although cell apoptosis was observed in the fluoride alone group, it was not more prominent than in the fluoride: hardness ratio group, and the cell apoptosis in the fluoride alone group was higher than in the hardness alone group. Accordingly, morphological analysis of Vero cells revealed the cellular damage under fluoride and hardness. Furthermore, the combined exposure to fluoride and water hardness exhibits a more pronounced nephrotoxic effect compared with exposure to fluoride or water hardness alone. Hence, the synergistic effect of fluoride and the hardness of drinking water may be a causative factor for CKDu in Sri Lanka.

Keywords: CKDu, Fluorescent microscopy, Nephrotoxicity, Phase contrast microscopy, Vero cells

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AQUATIC BIOLOGY

AB01

SUBSTITUTION OF STRONTIUM ION IN FLUORAPATITE DERIVED FROM DICALCIUM PHOSPHATE DIHYDRATE (DCPD)

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Fluorapatite (FAp, $Ca_{10}(PO_4)_6F_2$) exhibits ion-exchange properties that enable partial substitution of Ca^{2+} by Sr^{2+}, resulting in strontium-substituted fluorapatite (SrFAp), which would promote tooth remineralization through synergistic effects of Sr^{2+} and F^- ions. Although previous studies have elucidated synthesis methods, formation mechanisms, and substitution control, the upper limit of Sr incorporation and associated lattice parameter variations remain insufficiently characterized. In this study, SrFAp was synthesized by systematically varying the Sr concentration in the precursor solution to examine the relationship between Sr substitution ratio, crystal structure, and particle morphology. For this purpose, an aqueous solution (200 mL) containing 20 mg L^{-1} fluoride ions and different concentrations of strontium ions was prepared, followed by the addition of 0.20 g of dicalcium phosphate dihydrate (DCPD). The suspension was agitated for three days. Strontium concentrations were adjusted relative to the stoichiometric amount required for complete Ca substitution in the FAp phase derived from 0.20 g of DCPD. After reaction, the solid phase was recovered by filtration and dried. Crystalline phases were analyzed using X-ray diffraction (XRD), while particle morphology and elemental distribution were examined via scanning electron microscopy coupled with energy-dispersive spectroscopy. Furthermore, samples were dissolved in nitric acid, and Ca, P, and Sr contents were quantified by inductively coupled plasma atomic emission spectroscopy to determine elemental ratios. It was found through XRD analysis that the substitution rate was increased with higher Sr concentrations in the precursor solution, reaching a maximum of 74% at 1000% Sr concentration. Additionally, the (Ca+Sr)/P ratio also exhibited an upward trend with increasing Sr content, suggesting the potential for further substitution. An inflection point in substitution behavior was observed between 550% and 650% Sr concentration. Moreover, due to the larger ionic radius of Sr^{2+} compared to Ca^{2+}, d-spacings increased with higher Sr substitution. For the (300) plane, d-spacing continued to increase between 950% and 1000%, whereas for the (002) plane, no significant change was observed in this range. These results indicate that substitution at one Ca site has reached saturation, while the other site remains partially available, consistent with the presence of two distinct Ca sites in the FAp structure. These findings provide fundamental insights into the structural features of SrFAp and its potential applications in biomaterials.

Keywords: Crystal structure, Ion-exchange, Strontium-substituted fluorapatite, Substitution ratio, X-ray diffraction

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AB02

TOXIC EFFECTS OF Cd, Pb, Zn and Cr ON EARLY EMBRYONIC DEVELOPMENT OF ZEBRAFISH (*Danio rerio*)

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Heavy metal contamination poses severe ecological risks to aquatic ecosystems, particularly affecting early embryonic development in aquatic vertebrates. Anthropogenic sources, including industrial effluents, agricultural runoff, municipal wastewater, and landfill leachates, are the primary contributors to heavy metal pollution. This study evaluated the toxicological effects of Cadmium (Cd), Lead (Pb), Zinc (Zn), and Chromium (Cr) using Zebrafish (*Danio rerio*) embryos, focusing on mortality, hatching success, heart rate, and morphological abnormalities. They offer external fertilization, rapid embryonic development, and optical clarity. Zebrafish embryos (n = 20 per treatment, in triplicate) after 2 hours post-fertilization (hpf) were exposed to 1 mg L^{-1} Zn, 5 µg L^{-1} Cd, 20 µg L^{-1} Cr, and 2 µg L^{-1} Pb, with distilled water as the control. Values were selected according to the SLSI guidelines suitable for aquatic life. By 96 hpf, Cd exposure resulted in the highest mortality (80.0±0.6%), followed by Cr (70±0%), Zn (60.0±1.2%), Pb (60±0%), and 0% in the control. Hatching rates at 72 hpf were 40.0±1.2% (Zn), 30.0±0.6% (Pb, Cr), and 20.0±0.6% (Cd), compared to 90.0±1.2% in controls. Surviving larvae exhibited altered heart rates: 192±0 bpm (Zn), 192±2 bpm (Cr), 144±4 bpm (Cd), and 186±0 bpm (Pb), while controls averaged at 140±2 bpm. Morphological defects included bent body axis (Cr) and yolk sac edema (Zn) among 15% of the larvae, and behavioral hyperactivity in 10% of larvae (Cd, Pb). No abnormalities were observed in controls. These findings demonstrate that Cd, Pb, Zn, and Cr induce developmental toxicity and mortality in zebrafish embryos, underscoring the long-term ecological consequences of heavy metal pollution, including biodiversity loss. The results highlight the urgent need for stringent regulations, continuous environmental monitoring, and mitigation strategies to reduce heavy metal contamination in aquatic ecosystems.

Keywords: Hatching rate, Heavy metals, Morphological abnormalities, Mortality rate, Zebrafish

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AB03

ROLE OF WATER IN THE GROWTH, PIGMENT PRODUCTION, AND BIOACTIVE COMPOUND EXTRACTION OF *Spirulina platensis*

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Microalgae are valuable sources of bioactive compounds and have gained great interest in the health, nutraceutical, and cosmeceutical industries. The synthesis of metabolites and algal growth largely depends on water quality and availability. This study describes the cultivation, extraction, and characterization of *Spirulina platensis*, emphasizing the fundamental role of water in recovering antioxidant-rich compounds and enhancing biomass production. *S. platensis* was cultivated in Zarrouk's medium and inoculated at a 1:4 (v/v) proportion. Growth was monitored spectrophotometrically at 560 nm, and biomass was harvested during the stationary phase by muslin cloth filtration and washed to a pH of 6-7. The pigment content and composition of bioactive compounds were analyzed in the freeze-dried biomass. Phycobiliproteins were extracted from dry biomass using distilled water, 50% hydroethanol, and 50% hydromethanol as solvents. The highest concentrations of C-phycocyanin (6.892±0.406 mg mL^{-1}), phycoerythrin (0.401±0.024 mg mL^{-1}), and allophycocyanin (1.121±0.131 mg mL^{-1}) were obtained using water as the extraction solvent. Antioxidant assays revealed a total phenolic content of 120.64±11.75 mg GAE g^{-1}, a total flavonoid content of 60.00±17.68 mg QE g^{-1}, and DPPH radical scavenging activity of 415.57±12.17 µg mL^{-1}. GC-MS analysis identified three predominant bioactive substances: 4-Hydroxypyridine 1-oxide (16.50%), featuring antioxidant activity, 1-bromoeicosane (15.91%), exhibiting anticancer and anti-inflammatory potential, and 5-chlorobenzol[1,2,5] thiadiazol-4-ylamine (6.07%) possessing anticancer properties. The laboratory-cultivated *S. platensis* showed higher pigment levels, with C-phycocyanin 62.3%, phycoerythrin 61.4%, and allophycocyanin 59.5% higher than those in commercially sun-dried samples, demonstrating the advantages of controlled cultivation and freeze-drying. This research highlights the central role of water in supporting *S. platensis* culture and metabolite production. This, in turn, promotes the synthesis of antioxidants and health-beneficial compounds. These findings reveal the link between the utilization of water resources, the development of cosmeceutical and nutraceutical technologies, and algal biotechnology.

Keywords: Algal biotechnology, Antioxidants, Bioactive compounds, Phycobiliproteins, *Spirulina platensis*, Water resources

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AB04

MOLECULAR AND MORPHOLOGICAL TOXICITY EFFECTS OF TRIBUTYLTIN ON ADULT ZEBRAFISH (*Danio rerio*)

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Zebrafish (*Danio rerio*) have emerged as a valuable model organism in toxicological studies, particularly for investigating the effects of endocrine-disrupting chemicals (EDCs) such as tributyltin (TBT), a persistent pollutant in aquatic environments. TBT is known to disrupt endocrine function by elevating testosterone levels, impairing reproduction, and inhibiting the cytochrome P450 (CYP-450)-dependent aromatase system responsible for converting androgens (androstenedione and testosterone) into estrogens. This study evaluated the chronic effects of TBT exposure on reproductive and morphological parameters in adult zebrafish following a four-month exposure to three environmentally relevant concentrations (1, 10, and 100 ng L^{-1}). Biomarkers of endocrine disruption, including CYP19 gene expression, testosterone, and 17β-estradiol levels, were measured. Results demonstrated a dose-dependent reproductive impairment, with significant effects observed at 10 and 100 ng L^{-1} TBT. Enzyme-linked immunosorbent assay (ELISA) revealed a significant reduction ($p < 0.05$) in 17β-estradiol levels in TBT-treated fish, accompanied by a corresponding increase in testosterone levels with rising TBT concentrations. Molecular analysis showed a significant downregulation ($p < 0.05$) of brain-specific CYP19 mRNA expression in females exposed to 10 and 100 ng L^{-1} TBT, while no significant changes were detected in females exposed to 1 ng L^{-1} or in all treated males. These findings confirm the chronic toxicity of TBT, demonstrating its potential to disrupt reproductive endocrinology and gene expression in Zebrafish.

Financial assistance from the University of Sri Jayewardenepura (Grant No. ASP/01/RE/SCI/2017/11) is acknowledged.

Keywords*:* CYP19 gene, ELISA, Testosterone, Tributyltin, Zebrafish (*Danio rerio*)

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AB05

EFFECT OF WATERBIRD DROPPINGS ON THE WATER QUALITY: A CASE STUDY FROM MATARA, SRI LANKA

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Eutrophication is a major global problem in aquatic ecosystems, primarily driven by human activities but also influenced by natural factors. Waterbirds contribute to this process through nutrient-rich droppings, which release concentrated uric acid and act as a source of enrichment. This bird-induced nutrient loading, known as guanotrophication or ornithological eutrophication, can significantly impact water quality. This study investigates the relationship between water quality and nutrient inputs from waterbird droppings. The study was carried out at the University Lake, University of Ruhuna, Matara, Sri Lanka. The research spanned from May to October 2025, specifically focusing on areas where waterbirds roost along the margin. Six sampling sites, evenly distributed across areas of both high and low bird abundance, were examined. At each site, a comprehensive bird survey was carried out to determine the abundance and diversity of waterbird species inhabiting each sampling site. Bird species richness and diversity were quantified using diversity indices, including Simpson's diversity index, Shannon-Weiner index, and Simpson's measure of evenness using the software Ecological Methodology v. 7.3. At the same time, a series of water quality measurements were taken from each sampling site to evaluate the physicochemical status of the lake, including temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), and electric conductivity (EC), using portable meters. The Water Quality Index, calculated using the arithmetic index method, was used to compare water quality between sites with high and low bird abundance. In addition, plankton sampling was conducted with a 20 µm mesh plankton net, enabling the collection and analysis of both phytoplankton and zooplankton communities to determine their relative abundance and potential responses to nutrient enrichment. Statistical analyses were performed using Canoco v.5 software to evaluate the relationship between nutrient loading from waterbirds and changes in water quality parameters. Water quality parameters varied across sites, with sites of higher bird abundance showing lower DO and higher conductivity and TDS, while temperature and pH showed only slight site-to-site differences. A significant difference in both phytoplankton and zooplankton communities was observed between sites with high and low bird diversity. Phytoplankton species such as *Scenedesmus* sp., *Pediastrum* sp., *Euglena* sp., and *Phacus* sp. were notably more abundant, reflecting nutrient enrichment from bird droppings, which add nitrogen and phosphorus to the water. Similarly, zooplankton such as Rotifers, Copepods, and Ostracods were more abundant in bird-rich areas, indicating their preference for nutrient-enriched conditions. The findings highlight the influence of birds on water quality and emphasize the need for further research on strategies to mitigate ornithological eutrophication in aquatic ecosystems.

Keywords: Eutrophication, Guanotrophication, Nutrient enrichment, Plankton, Waterbirds

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AB06

ANALYSIS OF LEAD (Pb) AND ARSENIC (As) CONCENTRATIONS IN SKIPJACK TUNA (*Katsuwonus pelamis*) FROM SELECTED FISHING LOCATIONS IN SRI LANKA

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Marine pollution by heavy metals is a global issue. These pollutants are introduced into the marine environment through industrial activities, waste disposal, mining, and ship disasters. One such incident was the X-Press Pearl ship disaster on May 21, 2021, which involved 1,486 containers, including many chemicals and heavy metals. Such contaminants can enter the food chain, where bioaccumulation and biomagnification may occur. Skipjack tuna (*Katsuwonus pelamis*), a top-level predator and one of the most consumed fish species in Sri Lanka, can accumulate these metals, posing serious health hazards to consumers. Therefore, this study was carried out to determine the concentrations of lead (Pb) and arsenic (As), two of the most toxic heavy metals in skipjack tuna, particularly in areas impacted by the X-Press Pearl disaster. Fish samples were collected from Panadura, Sarakkuwa, Uswetakeiyawa, and Trincomalee. At present, results are available for the Panadura samples, while analysis of the other sites is currently in progress. In each fish, the dorsal and tail muscles were analyzed separately. Samples were oven-dried (110 °C, 24 h), ground, and digested using 50% H_2O_2 and concentrated HNO_3. The digested solutions were analyzed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) at the accredited laboratories of the Industrial Technology Institute. For the Panadura samples, the mean concentration of arsenic in dorsal and tail muscles was 1.203 (±0.302) and 0.605 (±0.141) mg kg^{-1}, respectively, showing a significant difference at 95% confidence level. Lead concentrations in dorsal and tail muscles were 0.983 (±0.472) and 0.980 (±0.452) mg kg^{-1}, respectively, with no significant difference between them at 95% confidence level. These preliminary results from Panadura indicate that the concentration of lead exceeds the acceptable safety limit according to FAO/WHO permissible limits (0.2 mg kg^{-1} for Pb and 0.5 mg kg^{-1} for inorganic As), highlighting a potential risk to public health through fish consumption. Ongoing analysis of samples from the remaining locations will provide a more comprehensive assessment of heavy metal contamination in Sri Lankan fisheries.

Keywords: Bioaccumulation, Heavy metals, Marine pollution, Skipjack tuna, X-Press Pearl disaster

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AB07

CHEMICAL CHARACTERIZATION OF *Chlorococcum aquaticum* GROWN IN AUTOMOBILE WASTEWATER

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Wastewater from automobile service centers contain high levels of organic and inorganic pollutants, including oils, heavy metals, and nutrients, which can pose significant environmental and health risks if discharged untreated. Microalgae offer a sustainable solution by simultaneously treating wastewater and producing nutrient-rich biomass suitable for biofertilizer production. In this study, *Chlorococcum aquaticum* was cultivated for 14 days in a dilution series of automobile wastewater 25%, 50%, 75%, and 100% wastewater (T1-T4), with 100% distilled water as the control. Samples were monitored at 0, 4, 7, 10, and 14 days for pH, total dissolved solids, conductivity, and optical density to determine the optimal wastewater dilution for algal growth. Among treatments, 50% wastewater dilution (T2) was selected as optimal because it maintained a stable slightly neutral to alkaline pH (7.65-10.10) ideal for algal growth, total dissolved solids steadily increased (207.0-207.2 mg L^{-1}) without harming the biomass, conductivity rose gradually (139.3-232.0 μS) without extreme peaks, providing a balanced nutrient environment, and optical density was highest, indicating maximum biomass yield. After 14 days, T2 yielded a mass of (0.03±0.01) g. Dried biomass was subjected to detailed chemical characterization alongside the control grown in BBM. Comparison with the control showed that the wastewater-grown biomass produced a higher yield and contained higher total nitrogen (1.17 mg L^{-1}) and phosphate (0.13 mg L^{-1}) levels than the control biomass (0.60 mg L^{-1} total nitrogen; 0.86 mg L^{-1} phosphate), confirming that the algae benefitted from the nutrient-rich wastewater. Additional metal-oxygen bonds, strong amide bands, and more polysaccharides in the experimental biomass revealed by Fourier transform infrared spectroscopy confirm effective bioremediation by algae. Total phosphate content and total nitrogen content were within the range 0.5-5.0% (w/w) and 2.0-5.0% (w/w), respectively, with slightly alkaline pH ranges (9.48-8.04), which are suitable for biofertilizers. X-ray fluorescence (XRF) spectroscopic analysis revealed that the original wastewater contained only trace nickel (0.91%), copper (0.64%), and no heavy metals. The presence of essential elements such as potassium (6.26%), calcium (39.67%), manganese (6.62%), and iron (37.34%), and the absence of toxic heavy metals, chromium, lead, and mercury confirmed through XRF analysis, confirmed its non-toxicity. Study showed that *C. aquaticum* effectively removes pollutants from automobile wastewater while producing safe, nutrient-rich biomass, demonstrating its feasibility for developing an integrated wastewater bioremediation–biofertilizer production technology.

Keywords: Automobile wastewater, Biofertilizer, Bioremediation, *Chlorococcum aquaticum*, Nutrient-rich biomass

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AB08

POTENTIAL USE OF MICROBES AND MICROBIAL GENES OF MAHA OYA HOT SPRING IN BIO FERTILIZER PRODUCTION

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Chemical fertilizers cause soil infertility, water pollution, eutrophication, accumulation of heavy metals, and several other environmental problems. Thus, biofertilizers are preferred over chemical fertilizers due to their lower cost, greater environmental friendliness, and long-term agricultural production. Hence, farmers are encouraged to use biofertilizers in the agricultural field. The productivity of the biofertilizer production process can be maximized by using high temperatures during the process. Therefore, thermal tolerant bacteria can be successfully used in biofertilizer production. In the present study, the potential of the hot spring microbial community in Sri Lanka for the production of biofertilizer was studied. Water samples were collected from the surface and bottom of the Maha Oya hot springs in Sri Lanka. The temperature, conductivity, pH, and dissolved oxygen (DO) were measured at the site using portable meters, and microbial genomic DNA was extracted using the MoBio Power Water DNA extraction Kit. Shotgun metagenomic sequencing was performed on the Illumina HiSeq platform at Omega BioServices, USA. Bioinformatics analyses were conducted using MEGAHIT software for *de novo* metagenome assembly and FragGeneScan for the prediction of genes and proteins in Metagenome Assembled Genomes. Results indicated that temperature, Electrical Conductivity, pH, and DO of the surface and bottom of the spring varied from 51.7-52.4 °C, 1487-1507 µS cm^{-1}, 8.05-8.07, and 2.01-2.05 mg L^{-1}, respectively. Genus *Mycolicibacterium* (77.2%) followed by *Mycobacterium* (6.7%), *Pseudonocardia* (3.1%), *Meiothermus* (2.2%), *Brevundimonas* (1.9%), *Brevibacterium* (1.1%) and *Achromobacter* (1.0%) were the dominant bacterial genera in Maha Oya Hot Spring. Moreover, *Azotobacter, Rhodospirillum, Anabaena, Nostoc, Azospirillum, Rhizobium*, and *Frankia*, which are commonly used in biofertilizer production, were detected in considerable numbers. Further, genes that code for Nitrogen fixation, *nifD, nifH*, and *nifK*; Sulfate reduction, *cysC* and *cysD*; Cellulose degradation, *Egl, cwp84, pslG, yhfE, esaA, bhp, abfB, ipqP, frvX* and *ftsZ*; Nodulation, *nodA, nodB* and *nodI*; and plant growth hormone, *yvdD, ASA1*, which are commonly and efficiently used in organic fertilizer production, were detected. Thus, the results of the present study implied that the Maha Oya hot springs could be a useful source of bacteria and bacterial genes for the production of biofertilizers.

Keywords: Biofertilizers, Biotechnology, Extremophiles, Hot springs, Metagenomic analysis

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AB09

IMPACT OF MICROPLASTICS ON FRESHWATER ZOOPLANKTON IN THE MAHAWELI RIVER, KANDY

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Microplastics, defined as plastic less than 5 mm in diameter, have emerged as a significant pollutant in aquatic ecosystems, posing threats to biodiversity and ecosystem functioning. Zooplankton, being primary consumers in both freshwater and marine ecosystems, play a crucial role in energy transfer and nutrient cycling, yet their vulnerability to microplastic contamination in Sri Lankan freshwater rivers remains poorly understood. The present study investigates the impact of microplastic pollution on the abundance and diversity of zooplankton in selected sites of the Mahaweli River, Kandy. Water and sediment samples from four selected sites were collected between May and September 2025 to analyze microplastic content. Surface water was sieved (500 and 45 µm), while sediment samples were dissolved in NaCl solution, sieved, oxidized, and subjected to density separation. Microplastics were identified using a stereomicroscope. Zooplankton species were identified and quantified using samples obtained with a 20 µm pore size plankton net. Water quality parameters, including dissolved oxygen, conductivity, total dissolved solids, temperature, and pH, were measured to assess their combined influence. Statistical analyses were performed using Canoco v.5 software and Microsoft Excel 2024 to evaluate the relationship between zooplanktons, microplastics, and water quality. Preliminary findings revealed a significant presence of plastic fibers in both sediment and water samples, followed by fragments, sheets, and foams, with blue being the predominant color. Zooplankton species such as *Keratella* sp. (382-632 individuals m^{-3}), *Notommata* sp. (63-425 individuals m^{-3}), *Cladocera* sp. (13-38 individuals m^{-3}), Nauplius larva (157-325 individuals m^{-3}), *Euchlanis* sp. (50-125 individuals m^{-3}) and *Cyclops* sp. (150-475 individuals m^{-3}) were observed, with relative abundances varying across sites. These results suggest a potential negative association between microplastic prevalence and zooplankton diversity. Further analyses aim to clarify the extent to which microplastics and water quality parameters influence zooplankton communities. Future research in the Mahaweli River could focus on quantitatively assessing the impact of microplastics on zooplankton abundance, as well as examining the effects of microplastic bioaccumulation in zooplankton.

Keywords: Mahaweli River, Microplastics, Sediment, Surface water, Zooplanktons

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AB10

STUDY OF PHYSICOCHEMICAL PARAMETERS AND PLANKTON COMMUNITIES IN SELECTED LOCATIONS OF KELANI AND MAHAWELI RIVERS, SRI LANKA

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The Kelani and Mahaweli Rivers are major freshwater systems in Sri Lanka, influenced by distinct anthropogenic activities; the Kelani River flows through a heavily industrialized region, while the Mahaweli River primarily traverses agricultural landscapes, resulting in differing pollution pressures. As plankton serve as sensitive environmental indicators, examining their relationship with physicochemical parameters provides valuable insights into temporal changes in water quality. Thus, the variation in plankton communities in Kelani and Mahaweli Rivers was investigated to assess the environmental changes and water quality status of both rivers. A 4-km stretch from each river was selected, with five sampling sites (from Pugoda to Kapugoda in the Kelani and from Peradeniya to Dodamwala in the Mahaweli) representing spatial variations influenced by industrial, domestic, agricultural, and natural factors. Sampling was conducted once a month from June to October 2025, during the morning (0600-0800 h). On-site measurements of several important physicochemical parameters, including pH, temperature, total dissolved solids (TDS), conductivity, and dissolved oxygen (DO), were made using portable meters. Laboratory analysis was conducted using samples obtained with a 20 µm pore size plankton net. Water quality index (WQI) was calculated using the weighted arithmetic index method to provide an integrative measure of river health. The relationship between plankton and the measured environmental variables was analyzed statistically using Canoco 5 for Windows and Microsoft Excel 2024. Throughout the study period, the Kelani River recorded higher water temperatures, while conductivity and TDS remained consistently higher in the Mahaweli River. pH remained stable in the Mahaweli River, whereas the Kelani River showed fluctuations, with lower values in June that stabilized by August. DO levels were similar, except in August when the Mahaweli River recorded lower values. Plankton analysis revealed *Staurastrum cingulum* and *S. arctiscon*, desmid species indicative of relatively good water quality, as the most abundant phytoplankton in the Kelani River, while *Aulacoseira* sp., a bloom-forming diatom associated with eutrophic conditions, dominated in the Mahaweli River. Zooplankton in the Kelani River was dominated by *Keratella* sp., Nauplius larvae, and *Lecane* sp., while the Mahaweli River was dominated by *Keratella* sp., *Cyclops* sp., and Nauplius larvae across all sites. WQI values indicated poor water quality in both rivers, with slightly better conditions in the Kelani River study area compared to the Mahaweli River study area.

Keywords: Kelani River, Mahaweli River, Plankton, Water quality, Water quality index

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