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2026

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FORWARD

It is with great pleasure that I present the proceedings of the **Annual Research Conference on Bioresources 2026 (ARCoB 2026)**, the first research conference organized by the Faculty of Urban and Aquatic Bioresources, University of Sri Jayewardenepura, under the theme "Exploring Urban and Aquatic Bioresources Towards a Sustainable Blue-Green Economy". This conference marks an important milestone in the faculty's commitment to advancing research, innovation, and scientific engagement in the field of bioresources. ARCoB 2026 was established with the vision of creating an annual platform where undergraduate researchers can showcase their scientific findings and innovations in urban and aquatic bioresource management.

The successful organization of ARCoB 2026 has been made possible through the generous financial support of the National Science Foundation (NSF) under the Support Scheme for Scientific Meetings and Events (SSSME) (Grant No. SSSME_2026-C01_G03). We sincerely appreciate this support, which has enabled us to establish a valuable forum for scientific communication and professional development.

I express my sincere gratitude to Senior Prof. Pathmalal Manage, the Vice Chancellor of the University of Sri Jayewardenepura, for his invaluable support. I would like to express my heartfelt gratitude to Senior Prof. Pradeep Jayaweera, Dean of the Faculty of Urban and Aquatic Bioresources, for his leadership and encouragement. I also extend my sincere appreciation to the keynote and invited speakers, editorial board, reviewers, session chairs, industry partners, authors, and the conference organizing committee for their commitment and invaluable contributions to the success of this event.

Most importantly, I congratulate all authors whose hard work, dedication, and passion for research have contributed to the success of this conference. As the first Annual Research Conference on Bioresources, ARCoB 2026 marks the beginning of a lasting tradition within the faculty, providing a platform for knowledge sharing, academic collaboration, and the dissemination of research findings. May this conference continue to foster scientific advancement and contribute to the development of future leaders in the bioresources sector.

Prof. J.A. Surani Chathurika
Editor-in-Chief, ARCoB 2026
Faculty of Urban and Aquatic Bioresources
University of Sri Jayewardenepura

Message from the Vice-Chancellor, University of Sri Jayewardenepura

It is my pleasure to extend my warm greetings to all participants of the Annual Research Conference on Bioresources 2026 (ARCoB 2026) organized by the Faculty of Urban and Aquatic Bioresources (FUAB), University of Sri Jayewardenepura.

As the inaugural Annual Research Conference of the Faculty of Urban and Aquatic Bioresources, ARCoB 2026 marks an important milestone in the faculty's journey towards advancing research, innovation, and sustainable development. Universities play a vital role in generating knowledge, encouraging innovation, and providing solutions to contemporary societal and environmental challenges. In this regard, research conferences serve as important platforms for the dissemination of scientific findings, scholarly dialogue, and the development of collaborative partnerships.

The conference theme, "Exploring Urban and Aquatic Bioresources toward a Sustainable Blue-Green Economy," reflects a timely and important focus. As Sri Lanka and the global community strive to balance economic development with environmental sustainability, scientific research and innovation are essential for the sustainable utilization of both urban and aquatic bioresources. I congratulate the Dean of the Faculty, the organizing committee of the ARCoB, and all contributors for their dedication in organizing this conference.

I also extend my sincere appreciation to the keynote speakers, presenters, sponsors, and participants whose involvement has made this event possible. I wish ARCoB 2026 every success and trust that the outcomes of this conference will contribute meaningfully to advancing knowledge, fostering collaboration, and supporting the sustainable development of Sri Lanka and beyond.

Senior Professor M. M. Pathmalal
Vice-Chancellor
University of Sri Jayewardenepura

Message from Dean, Faculty of Urban and Aquatic Bioresources

It is my great pleasure to welcome you to the Annual Research Conference on Bioresources 2026 (ARCoB 2026), organized by the Faculty of Urban and Aquatic Bioresources (FUAB), University of Sri Jayewardenepura.

ARCoB 2026 marks a significant milestone in our Faculty's journey as we host our inaugural annual research conference under the theme "Exploring Urban and Aquatic Bioresources Toward a Sustainable Blue-Green Economy." This conference provides an important platform for researchers, academics, students, industry professionals, and policymakers to share knowledge, present innovative research findings, and foster collaborations that address emerging challenges in sustainable bioresource management.

The diverse research contributions presented at ARCoB 2026 reflect the Faculty's commitment to generating knowledge that addresses real world challenges. Through its diverse conference tracks, the conference highlights advancements in urban bioresources, biotechnology, environmental sustainability, fisheries and aquaculture, aquatic ecosystems, pollution management, and related fields. These research efforts contribute to sustainable development and support evidence based decision-making for the benefit of society.

I extend my sincere appreciation to our keynote speakers, authors, reviewers, sponsors, and the organizing committee for their dedication and valuable contributions. I wish all participants a productive and rewarding conference experience and trust that the outcomes of ARCoB 2026 will contribute meaningfully to advancing knowledge, strengthening collaborations, and promoting sustainable development in Sri Lanka and beyond.

Senior Professor Pradeep Jayaweera
Dean
Faculty of Urban and Aquatic Bioresources
University of Sri Jayewardenepura

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Urban Bioresources and Blue Green Economy

URBAN FARMING AS A MEANS TO STRENGTHEN URBAN RESILIENCE DURING ECONOMIC, HEALTH AND CLIMATE RELATED SHOCKS IN COLOMBO

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External shocks, like economic crises, pandemics and an increase in extreme climate events can add significant pressure on the need of cities to provide an uninterrupted food supply. This was experienced globally under COVID-19 and even more in Sri Lanka due to its economic crisis. Urban farming gained momentum in Colombo during these crises, but support declined once conditions normalized. This study aimed to explore the applicability of global experiences with the integration of urban agriculture into urban planning could inform resilience-oriented urban development in Colombo, and to evaluate stakeholder perceptions on institutionalizing urban agriculture as a long-term urban development strategy. A mixed methods approach was employed, combining a literature survey of Global South with primary stakeholder data A questionnaire survey of 400 urban consumers was conducted across six spatial zones distinguished by combinations of population density (high, medium, low) and income level (high, low) in the Colombo District, complemented by 62 *Key Informant Interviews* with government officials, academic experts, government-supported urban producers, and urban agriculture-related small and medium-sized enterprises (SMEs). Quantitative data were analyzed using IBM SPSS software, applying descriptive and inferential statistics; qualitative responses were analyzed thematically. Findings revealed that 52% of randomly selected consumers were engaged in urban farming. Despite 96% of farming households acknowledged crisis-period benefits, 78% received no institutional support. Between 87% and 95% of farming and non-farming consumers supported continuous public promotion of urban agriculture. Among non-farming consumers, 40% expressed willingness to start urban farming; and despite space constraints being the most cited barrier, regression analysis revealed a significant positive relationship between space constraints and willingness to farm, suggesting that space-constrained residents remain motivated and are potentially open to space-efficient alternatives such as rooftop and vertical farming. Urban agriculture engagement showed no significant relationship with gender or age, indicating that farming in Colombo cuts across demographic groups. Across all stakeholder groups, limited policy integration, weak institutional coordination, inadequate technical support, and low public awareness were identified as key challenges. These findings collectively demonstrate that urban agriculture in Colombo is already widely practiced, crisis-responsive, and broadly endorsed across stakeholder groups, yet remains constrained by the absence of sustained institutional commitment. It is therefore recommended that urban agriculture be formally integrated into urban resilience frameworks, disaster preparedness strategies, and long-term urban development plans, supported by dedicated extension and agro-advisory services, promoting space-efficient cultivation and strengthened multi-stakeholder coordination mechanisms.

Keywords: food systems, institutional support, policy, stakeholder perceptions, urban shocks

IDENTIFICATION OF BEHAVIOURAL PATTERNS OF PURPLE SWAMPHEN (*Porphyrio porphyrio*) IN DIYASARU WETLAND PARK

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Wetlands are highly productive ecosystems that provide feeding, breeding, and resting habitats for diverse bird species. Understanding behavioural activities of aquatic birds is important for evaluating habitat utilization and ecological conditions within wetland ecosystems. This study investigated the influence of island and time of day on the behavioural patterns of Purple Swamphen (*Porphyrio porphyrio*) at Diyasaru Park. Field observations were conducted in two selected islands (Island 1 and Island 2) during three observation periods (Morning, Afternoon, and Evening) over a study period from December 2025 to May 2026. The selected islands exhibited ecological variations and habitat heterogeneity in terms of vegetation composition and geographical characteristics. Island 1 was dominated by dense emergent aquatic vegetation including grasses, sedges, and reed species with comparatively shallow water areas, while Island 2 consisted of mixed vegetation with open water regions and scattered aquatic plants. These variations in habitat structure potentially influenced habitat use and behavioural responses of Purple Swamphen. Behavioural activities including grazing, probing, picking, standing, sitting, walking, swimming, flying, calling, aggressive behaviour, group movement, head raising, escape response, vigilance, and sleeping behaviour were recorded using direct observation methods. Environmental factors observed during the study included vegetation cover, water depth, habitat structure, food resource availability, shelter availability, and surrounding habitat conditions, as these factors potentially influence movement patterns, foraging behaviour, and habitat utilization of Purple Swamphens IBM SPSS V.23 was used for statistical analysis and two-way Analysis of Variance (ANOVA) evaluate the effects of island, observation time, and their interaction on behavioural activities. In most behavioural activities, non-significant differences were resulted with observation time suggesting relatively stable behavioural patterns throughout the day. However, there were significant differences ($p<0.05$) between islands for probing, standing, walking, and swimming behaviours. Probing (island 1: 18.64 ± 11.32 , Island 2: 12.47 ± 9.15), standing (Island 1: 21.33 ± 13.41, Island 2 : 15.28 ± 10.76), and walking (Island 1 : 16.82 ± 10.25, Island 2 : 11.94 ± 8.63) times were significantly higher in Island 1, whereas swimming behaviour was significantly higher in Island 2 (Island 2 : 19.56 ± 12.48, Island 1 : 10.73 ± 7.84). Thus behavioural patterns of purple swamphen had varied according to the environmental factors. Overall, the findings emphasize the ecological importance of habitat heterogeneity in shaping behavioural activities of Purple Swamphen (*Porphyrio porphyrio*) and highlight the significance of urban wetlands in supporting avian biodiversity and ecological functions.

Keywords: biodiversity conservation, ecological monitoring, habitat heterogeneity, habitat utilization, urban ecology, urban wetlands

COMPARATIVE EVALUATION OF MODIFIED GROWING MEDIA AND PROPAGATOR ENVIRONMENTS ON THE ADVENTITIOUS ROOTING AND VEGETATIVE VIGOR OF *Catharanthus roseus* (L.) G.DON STEM CUTTINGS

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Catharanthus roseus L. G. Don is an economically significant medicinal and ornamental species, yet its vegetative propagation is often limited by poor rooting and low post-transplant survival. This study aimed to identify the optimal growing media composition and environmental condition (propagator vs. ambient) to maximize propagation success and post-uproot survival under tested conditions. A two-factor factorial Completely Randomized Design (CRD) was employed with 10 replicates per treatment, integrating seven growing media formulations (T1-T7) and two environmental conditions: a high-humidity polythene propagator environment and a conventional nursery (under 50% shade). The experiment was conducted at the Royal Botanic Gardens, Peradeniya. The standard nursery mixture (T1: topsoil: leaf mould: sand: cow manure at a 4:2:1:1: ratio) served as the control, while other treatments included varying proportions of coir dust, sand, leaf mould, and topsoil (ranging from modified organic-heavy combinations to 100% sand). Uniform 10 cm tip cuttings were treated with Indole-3-Butyric Acid (IBA) to enhance rooting and planted in sterilized media. Growth parameters were recorded at regular intervals. Cuttings remained in the nursery phase until day 56, with a critical uprooting assessment on day 35, before being transplanted into outdoor field beds. Data were analyzed using Two-Way ANOVA in IBM SPSS (version 23). Results indicated that the propagator environment facilitated a distinct numerical increase in early survival, while porous media T3 (17.333 ± 3.679 roots) and T4 (15.000 ± 2.850 roots) optimized root proliferation. Mean values identified medium T6 (topsoil and sand) as the most resilient, yielding the greatest vertical shoot growth (3.102 ± 0.168 cm). Although two-way ANOVA showed no statistically significant differences ($p > 0.05$) across treatments (shoot height $p = 0.380$; root number $p = 0.083$; longest root length $p = 0.844$), numerical trends favored well-aerated media under high-humidity conditions. Survival declined markedly after uprooting, confirming transplant shock as a major establishment barrier. Consequently, successful *C. roseus* propagation under these tested conditions requires the integration of high-humidity propagation, well-aerated media (T3, T4, or T6), and careful hardening-off to minimize root disturbance.

Keywords: *Catharanthus roseus*, growing media, propagator, transplant shock, vegetative propagation

DIVERSITY, SPATIAL DISTRIBUTION AND HOST PLANT ASSOCIATIONS OF WILD EPIPHYTIC ORCHIDS IN THE ROYAL BOTANIC GARDENS, PERADENIYA, SRI LANKA

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Orchidaceae is one of the most species-rich families of angiosperms, but data on orchid assemblages in managed botanical landscapes in Sri Lanka remains limited. This study assessed the diversity, spatial distribution, and host plant associations of wild epiphytic orchids in the Arboretum section of the Royal Botanic Gardens, Peradeniya. A systematic field survey was conducted to record orchid individuals, GPS locations, and evaluate host tree characteristics, including bark texture, diameter at breast height and root attachment patterns. Orchid species were identified using standard taxonomic floras, while diversity indices and statistical analyses were performed using SPSS Version 23. A total of 470 individual orchids representing seven epiphytic species were recorded across 46 host tree species. The assemblage consisted of *Cymbidium aloifolium* (most abundant, 28.72%), *Dendrobium macrostachyum* (least abundant, 2.97%), *Aerangis hologlottis* (11.27%), *Polystachya concreta*(9.78%), *Vanda testacea* (12.34%), *Thrixspermum pulchellum*(21.06%), and *Luisia tristis(13.82%)*. The Shannon–Wiener index (H′ = 1.80) indicated moderate orchid diversity, while Simpson's diversity index (D = 0.816) suggested high species variability with low dominance. Spatial analysis revealed a clustered distribution pattern associated with suitable host trees and favorable microclimatic conditions. *C.aloifolium*, *L.tristis*, and *P.concreta* were widely distributed, whereas *D.macrostachyum* showed a restricted distribution. *A.hologlottis* and *T. pulchellum* exhibited clustered distributions, while *V.testacea* was moderately widespread. Most orchid individuals occurred in lower canopy and branch microhabitats, with *T. pulchellum* frequently occupying branch-end habitats. Host association analysis showed that orchids colonized a wide range of host tree species, with *Bischofia javanica*, *Lagerstroemia speciosa*, and *Dipterocarpus zeylanicus* supporting the highest orchid richness. Orchid abundance was significantly associated with bark texture, with rough fissured bark supporting greater occurrence than rough medium bark (Cramer's V = 0.841, $p < 0.05$, SE = 0.4072 and 0.5276, respectively). In contrast, orchid abundance was not significantly related to host tree DBH ($r = 0.062$, $p = 0.516$). However, host trees supporting deeply anchored orchids had significantly greater DBH than those supporting surface-spread orchids ($t = 3.147$, $p < 0.05$). These findings highlight the importance of bark characteristics and habitat heterogeneity in shaping epiphytic orchid communities and emphasize the conservation value of mature rough-barked host trees in managed tropical landscapes.

Keywords: bark texture, biodiversity, epiphytic orchids, host plant association, spatial distribution, Royal Botanic Gardens - Peradeniya

EFFECT OF GYPSUM APPLICATION ON GROWTH, YIELD AND QUALITY OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) VAR. TISSA IN RED-YELLOW LATOSOLS OF KILINOCHCHI DURING THE MAHA SEASON

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Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in Sri Lanka, but its productivity in the Kilinochchi District is often limited by calcium and sulphur deficiencies in red-yellow latosol. This study was conducted at the Regional Agricultural Research and Development Centre, Kilinochchi, during the Maha season to evaluate the effects of different gypsum application rates and timings on the growth, yield and quality of groundnut (*var. Tissa*). The experiment was arranged in a Randomized Complete Block Design with five treatments (T_1 (control + recommended NPK), T_2 (20 kg gypsum/acre at 30 days), T_3 (20 kg gypsum/acre at 30 days + NPK), T_4 (20 kg/acre gypsum as basal + 20 kg/acre top dressing + NPK/acre at 30 days), and T_5 (40 kg gypsum/acre at 30 days + NPK)) and three replications. Data were analyzed using ANOVA, and means were separated using Tukey's HSD test at $p \leq 0.05$. Results showed that gypsum applications positively influenced growth and yield parameters. At 60 DAS, T_5 showed the highest plant height (39.36 ± 1.09 cm) and branches per plant (4.67 ± 0.58) compared to the control (37.53 ± 2.44 cm and 3.67 ± 0.58). Treatment T_5 recorded the highest number of pods per plant (42.00 ± 7.51), fresh pod weight (57.00 ± 7.81 g/plant), dry pod weight (41.67 ± 6.98 g/plant), and pod yield (2.31 ± 0.06 t/ha), with increases of 48.2%, 25.7%, 35.9%, and 28.4%, respectively, over the control. Pod yield ($p = 0.020$), kernel weight ($p = 0.003$), and shelling percentage ($p = 0.011$) were all significantly improved by gypsum application, with T_5 showing the highest values and increases of 28.4%, 19.8%, and 12.4% over the control, respectively. In conclusion, the application of 40 kg/acre of gypsum at 30 days after sowing along with the recommended NPK is the most effective treatment for increasing groundnut production in red-yellow latosol of Kilinochchi district during the Maha season.

Keywords: pod development, shelling percentage, soil amendments, soil chemical properties, yield enhancement

ASSESSING THE INFLUENCE OF GREEN ARCHITECTURAL PRACTICES ON TOURIST WELL-BEING AND SUSTAINABLE HOSPITALITY DEVELOPMENT IN SRI LANKA'S CENTRAL PROVINCE

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The growing demand for sustainable tourism has increased the importance of green architectural practices within the hospitality sector. This study aimed to assess the influence of green architectural design practices on tourists' psychological well- being, spending behaviors and to evaluate accommodation providers' willingness to invest in green architectural practices in the Central Province of Sri Lanka. A quantitative research approach was adopted using structured questionnaires administered to 137 tourists and 16 accommodation providers were included with representation from National Sustainable Tourism Certified and Sri Lanka Tourism Development Authority registered properties in the Central Province. Data were collected through online and on-ground survey method and analyzed using descriptive statistics and Pearson correlation analysis with IBM SPSS Statistics Version 22. A non-probability sampling technique was applied to select respondents based on accessibility and willingness to participate. Ethical approval for the study was obtained from the Ethical Review Committee, Faculty of Applied Sciences, University of Sri Jayewardenepura, and the research was conducted under academic and ethical guidance throughout the study period. The findings revealed that green architecture positively influenced tourists' mental well- being, spending behaviors and hospitality managers' willingness to invest. Pearson correlation analysis indicated highly strong positive relationship among psychological variables ($p < 0.001$) and a significant positive relationship was identified between tourists' willingness to pay for green architectural accommodations ($r = 0.337$, $SE = 0.039$, $p < 0.001$). Although this relationship were weak to moderate in strength, because this may be attributed to external factors such as accommodation prices, tourists' income variations, accommodation service quality or travel motivation conditions etc. Approximately 94% ($SE = 0.112$). of hospitality managers expressed willingness to invest in green architecture practices and to receive future policy support and demonstration. This study highlights the importance of green architectural designs in enhancing tourist experiences and supporting sustainable tourism and green hospitality development in Central Province, Sri Lanka.

Keywords: sustainable tourism, tourist's psychology, willingness to pay, willingness to invest

COMPARATIVE EFFICACY OF MAGNETIZED WATER ON THE AGRONOMIC AND YIELD PERFORMANCES OF BELL PEPPER (*Capsicum annuum*) AND LETTUCE (*Lactuca sativa*) IN URBAN FARMING SYSTEMS

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Urban agriculture has become increasingly important for enhancing food security and sustainable crop production under conditions of rapid urbanization and limited agricultural land availability. This study evaluated the effects of magnetized water on the vegetative growth performance of bell pepper (*Capsicum annuum* L.) and lettuce (*Lactuca sativa*) under different urban farming systems, including soil/coir dust media and hydroponic cultivation. Three sub-experiments were conducted to assess the influence of magnetized water on plant height, leaf production, branching, root length, fresh weight, and total leaf area using linear mixed model analysis. In soil-grown bell pepper plants, magnetized water significantly enhanced plant height ($p = 0.0067$) and primary branch development ($p = 0.0004$), with significant Treatment × Week interactions indicating that treatment effects became more pronounced during later growth stages. However, leaf number and secondary branching were primarily influenced by plant maturity (week) rather than treatment. In hydroponically grown bell pepper seedlings, plant height increased significantly over time, and significant interaction effects observed during weeks 6 and 7 ($p < 0.001$) demonstrated enhanced vegetative growth under magnetized water treatment. Root length also showed positive growth trends, although treatment effects were only marginally significant. Leaf production and branching in hydroponic bell pepper were mainly influenced by growth duration (week). Among all experiments, hydroponically grown lettuce exhibited the strongest response to magnetized water. Significant treatment effects were observed for plant height, fresh weight, root length, and total leaf area ($p < 0.05$), indicating improved biomass accumulation, root development, and leaf expansion. Overall, the findings suggest that magnetized water positively influences vegetative growth and biomass production, particularly in hydroponic lettuce and soil-grown bell pepper systems, highlighting its potential as a sustainable and low-cost technology for urban agriculture and controlled environment farming.

Keywords: controlled environment farming, hydroponics, irrigation efficiency, sustainable agriculture urban cultivation, water treatment

BLUE COLOUR INORGANIC SURFACE COATING FOR ALUMINIUM SHEETS USING α-TITANIUM PHOSPHATE DERIVED FROM ILMENITE BEACH SAND

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The development of durable and environmentally friendly protective coatings for aluminium surfaces is important for improving their resistance to weathering and corrosion in outdoor applications. This study aimed to develop a weather resistant blue inorganic surface coating for aluminium sheets using α-titanium phosphate synthesized from Sri Lankan ilmenite beach sand as a value-added mineral resource. α-titanium phosphate was synthesized through phosphoric acid digestion of ilmenite followed by repeated washing and drying. The synthesized material was characterized using X-ray diffraction (XRD), which confirmed the successful formation of crystalline α-titanium phosphate. Before coating the paint application, aluminium sheets were mechanically roughened using sand paper and it promotes coating adhesion with Al sheets so it balances the effect of corrosion of Al sheets and chemically pre-treated by forming the phosphate layer on Al sheets to enhance coating adhesion. The coating formulation was prepared using α-titanium phosphate, cobalt (II) acetate tetrahydrate, phosphoric acid, tetraethyl silicate, and chromium (III) chloride hexahydrate. After the application and heat treatment, a stable slate blue coloured inorganic coating was produced. The performance of the developed coating was evaluated under exposure to HCl, NaOH, H2SO4, HNO3, distilled water, seawater, rainwater, and ultraviolet radiation. The coating exhibited good resistance to HCl and excellent stability in distilled water, seawater, rainwater, and ultraviolet exposure, with minimal changes in appearance. However, low stability was observed under strongly alkaline conditions and concentrated acidic environments. In this stage coating morphology, was observed by visual observation and it should be observed using Scanning electron microscope SEM and coating composition should characterized using X – ray diffraction (XRD) in future. The results demonstrate that α-titanium phosphate derived from Sri Lankan ilmenite can be successfully utilized as a functional inorganic coating material with promising weather resistant properties. The coating exhibited good resistance to different condition that are the evidence of weather resistance. The α-titanium phosphate has previously been used as an inorganic coating for ceramic coating but it has not previously been used as an inorganic coating for Al sheets. The existing inorganic coatings for aluminium are high cost but using the Ilmenite in Sri Lanka, it is a good cost-effective inorganic coating for Aluminium. How the developed coating differs from existing inorganic coatings for aluminium This study highlights the potential of utilizing locally available mineral resources to produce sustainable, value added coating materials for outdoor aluminium applications and other weather exposed metallic surfaces.

Keywords: aluminium coating, ilmenite derived material, inorganic pigment, surface protection

SYNTHESIS OF SODIUM IRON PYROPHOSPHATE CATHOD MATERIAL USING IRON RICH PHOSPATE LEACHATE GENERATED FROM ALPHA TITANIUM PHOSPHATE SYNTHESIS

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The growing demand for sustainable energy storage systems and resource efficient waste management strategies has increased interest in the recovery of valuable materials from industrial waste streams. This study investigated the synthesis of sodium iron pyrophosphate ($NaFeP_2O_7$) using iron recovered from phosphoric rich leachate that generated as an industrial waste during alpha titanium phosphate (α-TiP**)** synthesis using Sri Lankan ilmenite. The research aimed to transform a waste derived iron source into a value added polyanionic material with potential application as a cathode material for sodium ion batteries. A controlled co-precipitation method was employed to recover iron from the leachate. The acidic solution was neutralized using sodium hydroxide, resulting in the formation of a hydrated iron phosphate precursor at pH 3.5. The precursor was subseq-uently aged, filtered, washed, oven dried at 110°C, and calcined at 650°C to promote pyrophosphate formation and crystallization. The synthesized material was characterized using X-ray diffraction (XRD) and UV-Visible spectroscopy. XRD analysis confirmed the successful formation of monoclinic $NaFeP_2O_7$ belonging to the $P2_1/c$ space group. The refined lattice parameters were determined as a = 9.5677 Å, b = 7.9018 Å, c = 7.3222 Å, β = 111.79°, with a unit cell volume of 514.01 $Å^3$. The diffraction pattern showed good agreement with ICDD Card No. 00-036-1454, confirming phase formation and structural integrity. UV-Visible spectroscopy revealed a prominent absorption band at 281 nm, characteristic of Fe^{3+} ligand to metal charge transfer transitions, confirming the presence of iron-oxygen coordination environments in the precursor system. The results demonstrate that industrial leachate can serve as an effective and low cost iron source for the synthesis of sodium iron pyrophosphate. This approach provides a sustainable pathway for industrial waste valorization while producing a structurally stable material with potential applications in next generation sodium-ion battery technologies.

Keywords: co-precipitation, industrial leachate, iron recovery, sodium-ion battery, UV–Visible spectroscopy, waste valorization, X-ray diffraction

EVALUATING THE EFFECT OF SUBSTRATE COMPOSITION ON IRRIGATION DEMAND IN SMART-IRRIGATED SYSTEM INTENDED FOR TROPICAL LIVING WALLS

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Rapid urbanization has increased interest in modular living wall systems (MLWs) as a sustainable strategy for enhancing urban environmental quality. However, the long-term sustainability of MLWs in tropical climates is strongly influenced by irrigation demand. While moisture-responsive smart irrigation systems are recognized as water-efficient technologies, the influence of substrate composition on irrigation demand under controlled moisture conditions remains insufficiently understood. Therefore, this study evaluated the effect of different recycled demolition waste (DW) based substrate compositions on irrigation demand and water-use efficiency under moisture-responsive smart irrigation. Four substrate mixtures containing recycled mixed DW and organic amendments (compost and coco peat) were developed and evaluated using an Arduino-based five-channel moisture-responsive irrigation system to maintain near-field-capacity conditions for each substrate independently, with *Epipremnum aureum* as the test species. The experiment was conducted over eight weeks using a completely randomized design with five treatments (including the organic control) and four replicates. A total of 5006 continuous irrigation cycles were evaluated during the experimental period. Moisture normalization and system validation analyses confirmed that comparable moisture availability was maintained across all substrate compositions despite differences in substrate physical characteristics. Substrate composition significantly influenced bulk density, porosity, and water-holding capacity, resulting in distinct irrigation demand patterns. Plant growth responses across substrate compositions remained statistically similar among treatments under comparable moisture conditions. Water use efficiency, expressed as biomass produced per unit of water applied, varied significantly among substrate compositions ($F = 124.08$, $p < 0.001$); 50:50 and 40:60 substrate compositions exhibited the highest water use efficiencies, indicating that substrate compositions with similar plant growth outcomes may differ substantially in irrigation demand. These findings indicate that smart irrigation alone does not guarantee maximum irrigation efficiency, as substrate physical properties remain a critical factor governing the water demand of moisture-responsive smart irrigated systems. Integrating moisture-responsive irrigation systems with optimized substrate design may therefore provide an effective approach for improving the water efficiency and sustainability of tropical modular living wall systems.

Keywords: irrigation demand, living walls, smart irrigation, water use efficiency

FORMATION OF A LESS CORROSIVE CEMENT REMOVER USING MILD ACIDS AND FUNCTIONAL ADDITIVES

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Conventional cement removal agents predominantly rely on strong inorganic acids such as hydrochloric, phosphoric, and sulfuric acids. While effective in dissolving cement residues, their use is associated with severe drawbacks, including metal corrosion, surface damage, environmental pollution, and health hazards. This study aimed to develop a sustainable, less corrosive cement remover using organic acids and other functional additives while retaining high dissolution efficiency. A series of formulations were prepared using sulfamic acid (SA), citric acid monohydrate (CAM), sodium D-gluconate (SG), and a non-ionic surfactant (NIS) in varying proportions ranging from 5-15% (w/w) of SA, 5-10% (w/w) CAM, 5-10% (w/w) SG, and 1% (w/w) of NIS. Cement dissolution efficiency was evaluated through weight loss measurements of pre-dried cement cubes at multiple time intervals. Formulations F-03 (with 5% each of SA, CAM and SG) and F-07 (with 10% SA, 5% each of CAM and SG) demonstrated superior performance, which was further enhanced with the incorporation of Tween 20, a non-ionic surfactant (1% w/w). The optimized formulations effectively disrupted the calcium-silicate-hydrate (CSH) network while maintaining low corrosiveness and pH stability at around pH=4, minimizing potential damage to metal surfaces. Upon incorporation of the NIS, percent dissolutions of cement cubes using F-03, and F-07 after 24 hours were respectively 88.2% and 71.0%. These values were higher in comparison to the formulations with no NIS (F-03- 85.5%, F-07- 69.6%). The cement removal mechanism can be explained mainly through acid attack and calcium complexation assisted by the acidity and descaling power of SA, acidity of CAM, chelation properties of SG and wetting power of NIS. The findings provide a scientific basis for environmentally friendly cement removers, offering safer and efficient alternatives for construction maintenance and industrial cleaning applications.

Key words: Cement mortar, CSH, Less corrosive cement remover, Sustainable cement remover

COMPARATIVE EVALUATION OF GROWTH RESPONSES IN SELECTED TOMATO (*SOLANUM LYCOPERICUM L.)* VARIETIES UNDER SUNLIGHT AND SHADE CONDITIONS

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This study evaluated the effects of three growing environments; Net House with Full Sunlight Condition (NHFS), Net House with Shade Net Condition (NHSN) and Open-Field Ambient Condition (OFAC) on the growth performance of five local improved varieties (*Lanka Sour*, *Bathiya*, *KC1*, *Ravi* and *Tharindu)* and two imported hybrid varieties (*Platinum* and *Aruni)*. The study was conducted at the University of Sri Jayewardenepura using a Randomized Complete Block Design (RCBD) with four replications. Growth parameters of plant height (PH), number of leaves (NL), stem diameter (SD), leaf width (LW), leaf length (LL), chlorophyll content (CH), number of flowers (NF) and number of fruits (NR) were measured during the experimental period of 6 months. One-way ANOVA with Tukey's post hoc test at a 95% significance level was used in accordance with Pearson correlation and simple linear regression analysis. The results indicated that SD (4.44±0.16cm and 4.60±0.42cm), CH (65.17±1.39 and 41.00±1.58), NF (16.80± 0.42 and 20.50±1.39) and NR (9.40±0.47 and 2.00±0.84) of *Aruni* and *Tharindu* respectively, were significantly higher under NHFS with 45% shade effect. PH (150.92±0.50cm and 117.64±0.88cm), LW (6.22±0.26cm and 5.88±0.12cm) and LL (11.18±0.24cm and 10.20±0.25cm) of *Aruni* and *Platinum* were significantly higher under NHSN with 55% shade effect. OFAC had inconsistent plant growth due to variation of the environment. The strongest positive correlation between PH and NR under NHSN conditions ($r = 0.726$) indicated that taller plants produce more fruits. Overall, *Aruni* performed best in most parameters as an imported variety. As a local variety, *Tharindu* performed best in NF and NR under NHFS conditions. The study concluded that NHFS with 45% shade effect provides the most favorable environment, and *Aruni* is a comparatively adaptive variety irrespective of the shade control.

Keywords: *Aruni*, controlled environments, light intensity, morphological variation

EVALUATION OF GROWTH AND MORPHOLOGICAL RESPONSES OF SELECTED TOMATO (*Solanum lycopersicum* L.) VARIETIES TO FULL-SPECTRUM WHITE LIGHT INTENSITIES IN A BALCONY-BASED VERTICAL GROWING SYSTEM

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Vertical farming is a vital food security strategy amid rapid urban population growth. However, integrating high-light-demanding tomatoes (*Solanum lycopersicum* L.) into shaded balconies remains challenging due to insufficient solar radiation. This study evaluated the vegetative growth of four locally adapted Sri Lankan tomato varieties (*Aruni, Bathiya*, *Tharindu*, and *Thilina*) under varying full-spectrum white LED intensities to identify optimal low-cost balcony lighting. The experiment was conducted at the Faculty of Urban and Aquatic Bioresources, Kohuwala, Sri Lanka (6°52'N, 79°52'E) using a Completely Randomized Design with five replicates in a 3-tier vertical cage under an 8-hour photoperiod (08:30–16:30 h). Four treatments were evaluated: 20W white LED at 549 lux (T1), 40W white LED at 776 lux (T2), outdoor ambient light at 316 lux (T3), and an indoor control at 167 lux (T4). Over 13 weeks, plant height (PH), number of leaves (NL), number of suckers (NS), stem diameter (SD), and chlorophyll content (CC) were recorded weekly and analysed using one-way ANOVA, Tukey's HSD ($\alpha = 0.05$), Pearson correlation, and linear regression in Minitab 16. All parameters showed statistically significant varietal differences ($p < 0.05$). Under T2, *Thilina* recorded the highest NL (86.0 ± 7.12^{a}) and NS (19.4 ± 1.4^{a}), compared to T4 (50.8 ± 6.24^{b} and 9.8 ± 0.73^{b}). T2 produced the greatest SD in *Aruni* (6.37 ± 0.17^{a} mm), *Tharindu* (6.37 ± 0.27^{a} mm), and *Thilina* (6.37 ± 0.45^{a} mm), and the highest late-stage CC in *Thilina* (51.82 ± 3.14^{a} SPAD). Conversely, T4 induced etiolation in *Bathiya* (83.62 ± 3.53^{a} cm; SD: 3.95 ± 0.16^{ab} mm) and the lowest CC (23.28 ± 5.87^{b} SPAD) and SD (2.93 ± 0.78^{a} mm) in Tharindu. These findings recommend 40W full-spectrum white LED at 776 lux as the most effective supplemental lighting for vegetative growth across diverse Sri Lankan tomato varieties in low-cost balcony systems.

Keywords: chlorophyll content, controlled environments, food security, supplemental lighting, vegetative growth, vertical farming

COMPARATIVE ASSESSMENT OF THERMAL REGULATION CONFIGURATIONS AND DEVELOPMENT OF AN IOT-BASED MONITORING SYSTEM FOR URBAN MINIATURE PROTECTED HOUSES

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Greenhouse microclimate management is critical for tropical crop production, where excessive air temperatures pose significant heat stress risks. Four cooling configurations of fan ventilation with full light (FVFL), fan ventilation with 50% shade (FVPL), passive ventilation with full light (NVFL), and passive ventilation with 50% shade (NVPL) were assessed in single non-replicated 7 ft × 6 ft × 5.5 ft protected houses alongside an outdoor reference (ACOR) at the University of Sri Jayewardenepura, Nugegoda, Sri Lanka (6.87°N, 79.90°E; agro-ecological zone WL1a; 26.5°C mean annual temperature; ~2,387 mm rainfall). A three-node ESP32-based IoT platform monitored microclimate at two-minute intervals using DHT22 sensors at three heights (0.30 m, 1.15 m, 2.00 m), yielding 60,201 records during the January to April 2026 dry inter-monsoon season (ambient: 28.6–32.8°C). One-way ANOVA with Tukey HSD post-hoc comparisons confirmed statistically significant inter-system daytime temperature differences ($F = 1188.4$, $p < 0.001$; $\eta^2 = 0.045$), with all six pairwise contrasts significant at $p < 0.001$. Fan-ventilated systems recorded lower daytime temperatures than passive counterparts (FVFL: 33.53°C vs NVFL: 35.52°C; FVPL: 33.69°C vs NVPL: 35.13°C), achieving cooling benefits of 1.99°C (Cohen's $d = 0.484$) and 1.44°C (Cohen's $d = 0.397$), respectively. All systems exceeded 30°C for 10–11 hours daily; fan systems exceeded 34°C for 6 hours, while in passive systems, exceeded for 7 hours ($p < 0.001$). Vertical stratification was highest in NVPL (TSI = 2.92°C, Cohen's $d = 0.544$), indicating roof-zone heat accumulation under passive shaded conditions. A Random Forest model predicted internal temperature 30 minutes ahead (test $R^2 = 0.818$, RMSE = 1.95°C; cross-validation $R^2 = 0.802 \pm 0.064$), providing an acceptable feasibility benchmark for predictive climate control. These results establish FVPL as the most effective and energy-efficient configuration, demonstrating that structured IoT monitoring combined with machine learning prediction offers a practical pathway for data-driven microclimate management in tropical urban protected agriculture.

Keywords: fan ventilation, greenhouse microclimate, IoT monitoring, Random Forest, shade net, thermal stratification

DESIGN AND EVALUATION OF MICROCLIMATE PERFORMANCE OF A FOOD FOREST THEMED GREEN ROOF IN AN URBAN AREA

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Rapid urbanization in Sri Lanka is contributing to the Urban Heat Island (UHI) effect, elevated rooftop temperatures, and declining urban thermal comfort. Green roofs have emerged as an effective nature based solution for improving urban microclimates. This study aimed to design and evaluate the microclimate performance of a food forest themed green roof system for improving rooftop environmental conditions. The study was conducted on the rooftop of a commercial building in Maharagama, Sri Lanka (6°50'50.04"N, 79°55'42.20"E). A food forest inspired green roof system was designed and implemented using 13 selected fruit, medicinal, and herbal plant species identified through a literature survey. Environmental parameters of air temperature and relative humidity were measured using DHT22 sensors, while light intensity (lux) was recorded using a BH1750 light sensor while soil moisture and soil temperature were measured using a fertility meter. Measurements were taken at five time intervals throughout the day (6:00 AM, 9:00 AM, 12:00 PM, 3:00 PM, and 6:00 PM) and were monitored and compared between the green roof and an adjacent bare roof from January to April 2026. Geographic Information System (GIS) techniques and Inverse Distance Weighting (IDW) interpolation were employed. Statistical analysis revealed that the mean temperature of the green roof (27.0 °C) was significantly lower than that of the bare roof (33.1 °C), resulting in an average reduction of 6.1 °C ($T = 8.57$, $p < 0.05$). Similarly, the mean relative humidity of the green roof (70.20%) was significantly higher than that of the bare roof (51.75%), with an increase of 18.45% ($T = -12.71$, $p < 0.05$). GIS-based spatial analysis further highlighted improved moisture retention and microclimatic conditions associated with vegetation cover. The findings confirm that food forest-based green roofs can significantly improve rooftop thermal performance and contribute to UHI mitigation in tropical urban environments.

Keywords: inverse distance weighting (IDW), Geographic Information System (GIS), green roof, thermal regulation, urban microclimate

EVALUATION OF MORPHOLOGICAL TRAITS OF SELECTED PAPAYA (*CARICA PAPAYA* L.) VARIETIES AT THE VEGETATIVE STAGE IN THE WET ZONE OF SRI LANKA

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Papaya (*Carica papaya* L.) is a commercially significant tropical fruit crop cultivated in Sri Lanka. This study was conducted at the University of Sri Jayewardenepura to morphologically characterize nine papaya varieties at the vegetative stage in the wet zone of Sri Lanka. The varieties comprised two locally developed cultivars (*Rathna* and *Horana Papaya Hybrid 01*), six imported commercial hybrid varieties (*Tainung 01, Tainung 02, Red Lady, Sun Lady, Maradona,* and *Vinayak*), and one local wild accession. The field experiment was laid out in an RCBD with two blocks, and three replicates each for four months period. Plant height, stem diameter, leaf length, leaf width, and chlorophyll content (SPAD) were recorded monthly over three consecutive months. ANOVA revealed significant varietal differences ($p \leq 0.05$) across all traits. At month 6, *Tainung 01* recorded the highest plant height (154±4.4 cm), while the local wild cultivar exhibited the greatest stem diameter (5±0.1cm), leaf length (32.90±1.7cm), and leaf width (43.40±1.2cm). *Vinayak* demonstrated superior chlorophyll content (63.80±1.1 SPAD) and the highest leaf count. *Rathna* consistently recorded the lowest values across most parameters. Leaf length and leaf width showed a moderate positive correlation at month 4 ($r = 0.63$), strengthening to $r = 0.72$ by month 5, while a weak negative association between chlorophyll content and plant height ($r = -0.13$) was observed. Principal Component Analysis revealed PC1 (65.5%) and PC2 (15.7%) together explained 81.2% of total variance, with PC1 representing an overall plant vigor axis. Hierarchical cluster analysis (k=3) differentiated varieties into three groups based on overall vigor, stem thickness, and leaf dimensions. These findings highlight substantial morphological diversity, with *Tainung 01, Vinayak*, and the local wild accession as best-performing varieties, providing a baseline for variety selection and crop improvement in the wet zone of Sri Lanka.

Keywords: *Carica papaya*, morphological characterization, vegetative stage, papaya hybrids, wet zone, Sri Lanka

ASSESSMENT OF MICROCLIMATE VARIABILITY IN URBAN INDOOR, COMPOUND, AND BALCONY SPACES AND ITS IMPACT ON SELECTED MEDICINAL PLANTS

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Urbanization alters local microclimatic conditions, yet the effects of indoor, balcony, and compound environments on medicinal plant growth remain poorly documented in tropical contexts. This study evaluated light intensity (LI), air temperature (AT), and relative air humidity (RH) across these three urban spaces at the University of Sri Jayewardenepura, Sri Lanka, and assessed their impact on *Azadirachta indica*, *Lantana camara*, and *Morus alba* over six months under a Randomized Complete Block Design (RCBD) with 6 replicates. Two-way ANOVA was performed for all nine parameters ($p \leq 0.05$). Regression models explained 89–91% of PH variation from week 5 onward, with stem diameter as the most consistent predictor. The compound space recorded intermediate to high LI (3,547–5,225 lux) and moderate AT (25.9–29.9°C); the balcony space showed the highest and most variable LI (4,177–12,027 lux) with the lowest RH (45.8–59.0%); and the indoor space had the lowest LI (152–189 lux), lowest AT (24.0–26.7°C), and highest RH (61.5–65.0%). Nine parameters; plant height (PH), stem diameter (SDM), internode length (INL), number of leaves (NL), petiole length (PL), leaf length (LL), leaf width (LW), number of branches (NB), and chlorophyll content (CC) were monitored at four evaluation intervals (weeks 1, 5, 9, and 13; W1–W13). Growth consistently followed the gradient compound ≥ balcony > indoor across species, with PH, LL, LW, and INL highest in compound-grown *M. alba* and lowest indoors; SDM and PL greatest in balcony-grown *A. indica* and lowest indoors; and NL and NB greatest in compound-grown *L. camara*; CC was likewise highest in balcony-grown *A. indica* and lowest indoors across all species. These findings demonstrate that urban microclimatic variation significantly influences medicinal plant growth and physiology, with compound environments providing the most favorable conditions for overall development.

Keywords: balcony gardening, indoor cultivation, light intensity, medicinal plants, plant growth, urban microclimate

FLORISTIC PATTERN AND COLONY PERFORMANCE OF HONEYBEES (Apis cerana) IN DIFFERENT AGROCLIMATIC ZONES OF SRI LANKA

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Honeybees play a vital role in pollination and ecosystem functioning and their productivity is strongly influenced by floral resource availability and environmental conditions. This study evaluates the floristic patterns and colony performance of Asian honeybee (Apis cerana) across five distinct agro-climatic zones in Sri Lanka, Matara, Kegalle, Gannoruwa, Nawalapitiya and Monaragala. The research aimed to identify the floral resources available in these ecosystems and determine their influence on honeybee productivity using Colony Performance Index (CPI). Floristic assessment was conducted within a 300meter radius of the apiaries at three weeks of intervals over a four-month period. Colony performance was assessed by recording the number of pollen carrying forages and total incoming bees during three daily observation periods (8:00-9:00a.m., 11:00-12:00p.m. and 3:00-4:00p.m.), and CPI was calculated as the ratio of pollen carrying foragers to total incoming bees within observation period. Data were analyzed using descriptive statistics, One-way ANOVA, and Tukey HSD tests using IBM SPSS statistics (v.32) at 95% confidence level. Floristic occurrence varied among locations, indicating differences in floral resource composition across agroclimatic zones. The highest Species richness was recorded in Matara, with 36 species including 27 plant families, while Asteraceae was the most frequently recorded plant family. Spatial variation among the agroclimatic zones did not have a statistically significant effect on overall colony performance ($F=0.573$, $p= 0.682$). Matara recorded the highest mean CPI (7.2±15.77) and Gannoruwa marked lowest (5.07±9.4), overall foraging activity remained relatively stable across the different locations. Significant differences in CPI within a day, observed in Matara($p=0.025$), Kegalle($p=0.003$) and Gannoruwa ($p<0.001$). The study concludes that Apis cerana exhibits high ecological adaptability across Sri Lanka's diverse landscapes. Short-term environmental factors, such as daily weather patterns and floral secretion cycles, appear to play a more dominant role in regulating foraging behavior than broader agro-climatic differences. These findings provide a foundational baseline for developing region-specific beekeeping management strategies and pollinator conservation efforts in Sri Lanka.

Keywords: apiary, beekeeping, colony performance index, floristic assessment, foraging activity, species richness

Biotechnology, Postharvest Innovations and Environmental Sustainability

DEVELOPMENT OF A MINIMAL PROCESSING PROTOCOL FOR EGGPLANT (*Solanum melongena L.)*

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Eggplant (*Solanum melongena* L.) is a widely consumed vegetable but suffers major postharvest losses. Fresh-cut eggplants are particularly vulnerable to enzymatic browning, moisture loss, and microbial contamination, which rapidly reduce their shelf life and consumer appeal. The study aimed to develop an effective minimal processing protocol using natural anti-browning treatments and appropriate packaging materials to maintain acceptable quality during refrigerated storage. The experiment was conducted as a two-factor Completely Randomized (CRD) with seven pretreatments: distilled water (Control), turmeric (1%, w/v), citric acid (1%, w/v), aloe vera (50%, w/v), ascorbic acid (1%, w/v), vinegar (5%, v/v) and a combined turmeric (1%, w/v) + ascorbic acid (1%, w/v) along with three packaging materials: low-density polyethylene (LDPE) bags (6×7 inches), polypropylene (PP) boxes, and biodegradable trays. Treated fresh-cut eggplant samples were first dipped in ice and then in treatment solutions for 5 minutes, packaged and stored at 5–7 °C for four days and evaluated for browning index, pH, titratable acidity, total soluble solids, weight loss, microbial quality, and sensory attributes. Two-way factorial analysis of variance (ANOVA), followed by Tukey's honestly significant difference (HSD) test, was used for statistical analysis. The combined turmeric and ascorbic acid treatment demonstrated the greatest reduction in enzymatic browning (browning index difference: -24.21±28.58) and was significantly ($p < 0.05$) different from aloe vera, citric acid, control, and vinegar treatments, attributed to the synergistic antioxidant activity of curcumin and the reducing action of ascorbic acid on polyphenol oxidase. Aloe vera and turmeric treatments were also effective in reducing browning and suppressing microbial growth. Packaging material significantly ($p < 0.05$) affected weight loss, which was lowest in Polyethylene bags and Polypropylene boxes (mostly <1%) and highest in biodegradable trays (1.00–7.94%), with no significant difference between PE and PP. Sensory evaluation (9-point hedonic scale) results revealed that the overall highest scores were for aloe vera (7.48 ± 1.41) and turmeric (7.38 ± 2.07) treatments. In conclusion, the combined turmeric + ascorbic acid treatment packaged in PE bags or PP boxes effectively extends the shelf life and consumer acceptability of minimally processed eggplant under refrigerated conditions.

Keywords: enzymatic browning, fresh-cut vegetables, natural anti-browning agents, polyphenol oxidase, postharvest preservation, shelf-life extension

ASSESSMENT OF AGRICULTURAL PLASTIC MULCH USE AND WASTE FLOWS IN SRI LANKA USING LIFE CYCLE AND MATERIAL FLOW ANALYSIS

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Agricultural plastic mulch is widely used in Sri Lanka because it helps improve crop production, conserve soil moisture, reduce weed growth and support modern farming practices. The increasing use of plastic mulch has also created environmental problems, including plastic waste generation, improper disposal and possible microplastic pollution in agricultural soils. In Sri Lanka, there is limited information regarding the quantities of plastic mulch imported, distributed, used and disposed of, making it difficult to develop proper management systems and policies. Therefore, this study aimed to assess the flow and fate of agricultural plastic mulch in Sri Lanka using Product Life Cycle and Material Flow Analysis approaches. The study used primary and secondary data collected during the period 2022–2025 to estimate the annual use and waste flows of agricultural plastic mulch in Sri Lanka. Material Flow Analysis was conducted using the mass balance principle and STAN2 software to identify how plastic mulch moves from import and distribution to agricultural use and final disposal. The study analyzed procurement methods, mulch types, provincial distribution, annual usage and disposal methods at the national level. The results showed that the annual plastic mulch usage in Sri Lanka was estimated at ~51 tonnes/year over ~296 hectares of cultivated land. The average lifespan of plastic mulch was 1.19 years, indicating rapid conversion into waste. Silver/black mulch was the most commonly used mulch type. About 90% of plastic mulch was supplied through government supported agricultural programs such as the Sri Lanka Good Agricultural Practices Program and modernization projects, while only a small amount was purchased from retail shops. The study also found that open burning was the main disposal method, accounting for more than 80% of total plastic mulch waste, while reuse and recycling practices were very low. The Material flow analysis results showed that the system mainly follows a linear flow pattern where plastic mulch is imported, used and disposed of with very limited recycling or recovery. The MFA indicated an annual inflow of 118.09 ± 9 tonnes/year and an outflow of 58.16 tonnes/year, resulting in a stock accumulation of 59.93 ± 9 tonnes/year within the system. The findings highlight the need for structured collection systems, recycling initiatives, and policy interventions to promote circular management of agricultural plastics in Sri Lanka.

Keywords: material flow analysis, plastic mulch, mulch disposal, mulch procurement

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EVALUATION OF COMMERCIALLY AVAILABLE YEAST FOR THE DEVELOPMENT OF A BIOLOGICAL FORMULATION TO MANAGE MANGO ANTHRACNOSE

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Mango is an economically and nutritionally important tropical fruit crop worldwide. However, anthracnose disease, mainly caused by *Colletotrichum gloeosporioides* affects both preharvest and postharvest stages, as infections often occur before harvest and become visible during fruit ripening after harvest. The disease causes significant yield and quality losses, while management mainly relies on chemical fungicides. Therefore, sustainable biological control strategies are needed to reduce fungicide dependence. This study evaluated the antagonistic potential of commercial yeast *(Saccharomyces cerevisiae)*, possessing antagonistic properties and established safety for human consumption, against anthracnose-causing fungi and to develop an effective biological control formulation for sustainable disease management. Anthracnose pathogens were isolated from infected mango fruits of the cultivars 'Karthakolomban' and 'Alphonso'. The isolates were identified based on the morphological characteristics and pathogenicity was further confirmed through Koch's postulation. The antagonistic activity of commercial yeast (*Saccharomyces cerevisiae*) was evaluated against *Colletotrichum gloeosporioides* using dual culture assays on potato dextrose agar (PDA) and its effectiveness was compared with a chemical fungicide (mancozeb) and a negative control (distilled water). A yeast-glycerol formulation (4.6×10^7 cells mL^{-1} in 20% glycerol) was tested on mango fruits under laboratory conditions to assess its ability to suppress disease. Results showed that yeast treatment completely inhibited fungal growth in the dual culture assay, recording 100 ± 0.00% inhibition throughout the 7 days of incubation period. In the laboratory fruit assay, yeast-glycerol formulation-treated fruits achieved 61.26 ± 8.23% inhibition of lesion development after 9 days of incubation, exceeding the inhibition achieved by mancozeb (45.12± 12.35%). These findings indicate that commercially available yeast formulations have strong potential as effective and sustainable biological control agents, offering a promising and eco-friendly alternative to chemical fungicides in anthracnose management. Furthermore, the results support the use of commercial yeast for developing reliable biological strategies for managing anthracnose in mango production systems.

Keywords: antagonistic yeast, biological control, dual culture assay, glycerol formulation, postharvest disease, sustainable disease management.

ISOLATION AND IDENTIFICATION OF EPIPHYTIC FUNGI FROM FRUIT SURFACE OF SELECTED MAJOR AGRICULTURAL CROPS IN SRI LANKA

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Epiphytic fungi colonize the external surfaces of fruits and vegetables without penetrating internal tissues and play significant roles in agricultural systems. Despite the economic importance of crops such as mango, coffee and brinjal in Sri Lanka, their epiphytic fungi remain undocumented under local agro-climatic conditions. This study aimed to isolate and identify epiphytic fungi from the fruit surfaces of mango (*Mangifera indica* 'Dampara'), coffee (*Coffea arabica* 'Catimor' and *Coffea canephora* 'Robusta') and brinjal (*Solanum melongena* 'HORDI Lenairi'). Samples (triplicate per variety) were collected between January and April 2026 from 3 cultivation locations at Horticultural Crop Research and Development Institute (HORDI), Gannoruwa, Sri Lanka. Isolation was carried out using surface washing and serial dilution plating on potato dextrose agar (PDA) and identification was based on macroscopic and microscopic morphology. A total of 64 isolates were recovered: 40 from coffee, 15 from mango and 9 from brinjal. Morphological characterization enabled the identification of 40 isolates (62.5%) to the genus level, representing 12 fungal genera: *Fusarium, Neocosmospora, Talaromyces, Cladosporium, Aspergillus, Mucor, Rhizoctonia, Alternaria, Curvularia, Penicillium, Sclerotinia* and *Pythium.* Coffee berries exhibited the highest overall fungal diversity, with 8 fungal genera identified, while coffee 'Catimor' and mango fruits recorded the highest numbers of isolates (n = 13 each). *Neocosmospora* (14.1%), *Fusarium* (12.5%) and *Talaromyces* (10.9%) were the most frequent fruit epiphytic genera recorded during the study. *Fusarium* predominated on mango (40.0% of isolates), whereas *Neocosmospora* was dominant on brinjal (44.4%). The detection of the genera *Aspergillus* and *Sclerotinia* members, carries food safety and disease management relevance. This study provides the first documented foundation of epiphytic fungi from selected crops in Sri Lanka, contributing valuable baseline information to an underexplored area of research. Further studies employing molecular identification and functional analyses are required to achieve species-level resolution and clarify the ecological roles of these fungi.

Keywords: brinjal, carposphere, coffee, fructoplane, mango, morphological characterization.

EFFECT OF PLASTIC MULCHING ON SUBSTRATE INDUCED SOIL MICROBIAL BIOMASS CARBON AND MINERALIZABLE NITROGEN IN MAIZE (*Zea mays* L.) UNDER TROPICAL DRY ZONE CONDITIONS.

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Plastic mulch films are widely used in agriculture to conserve soil moisture, regulate soil temperature, suppress weeds, and improve crop growth. However, their effects on soil biological processes under tropical dry zone conditions are not fully understood. Therefore, three field studies were conducted in maize (*Zea mays* L.) cultivated on Alfisol at the Field Crops Research and Development Institute, *Mahailupallama*, Sri Lanka. The site is located in the dry zone with a mean annual temperature of 27 °C and annual rainfall of 1000–1500 mm. The soil had a pH of 6.75 ± 0.1, and a total carbon content of 1.2%. Treatments used for the comparison were: no-mulch control, reflective low-density polyethylene (LDPE), black LDPE, and black biodegradable PFM. Soil samples were collected at the beginning and end of each season. Soil pH, electrical conductivity (EC), substrate-induced microbial biomass carbon (SIR-MBC), and potentially mineralizable nitrogen (PMN) were measured, and data were analyzed using two-way ANOVA. Soil pH showed variable responses, while EC mainly decreased from the initial to the final stage across seasons. Mulch treatment did not significantly affect SIR-MBC or PMN in season 1 initial stage, however, significantly higher SIR-MBC and PMN were observed in season 1 final stage, season 2 and season 3 ($p < 0.001$). The higher SIR-MBC and PMN under biodegradable plastic mulch in later seasons may be due to mulch degradation, which improved soil moisture, temperature regulation, and carbon availability for microbial activity. Overall, biodegradable plastic mulch showed potential to enhance soil microbial biomass carbon and mineralizable nitrogen under tropical dry zone conditions.

Keywords: biodegradable plastic mulch, microbial biomass carbon, plastic film mulch, potentially mineralizable nitrogen

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EFFECT OF MICROBIAL CONTAMINATION AND STORAGE CONDITIONS ON THE SHELF LIFE OF STRAWBERRY-FLAVORED DRINKING YOGURT AT MILCO DAIRY COMPANY, SRI LANKA

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Microbial contamination and improper storage conditions can adversely affect the shelf life, safety, and quality of drinking yogurt. This study investigated the effect of microbial contamination and storage conditions on the shelf life of strawberry-flavored drinking yogurt produced at MILCO Dairy Company, Sri Lanka. Samples were collected from raw milk (A), silo (pasteurized milk) (B), T2/T3 tank samples (C), unpasteurized mixture (D), just after pasteurization (E), after culture addition(F), farm tank sample (G) of the processing line in four sampling time slots (8.00-10.00 a.m.,(a) 10.30 a.m.-12.30 p.m.,(b) 1.00-3.00 p.m.,(c) and 3.30-5.30 p.m.(d)) and analyzed for Total Colony Count (TCC), pH, titratable acidity, and bacterial identification using gram staining and biochemical techniques. Shelf-life studies were conducted by storing the final product at 2°C, 6°C, and 10°C for 13 days. Data were statistically analyzed using IBM SPSS V.23. According to the results, the processing stage significantly affected microbial contamination ($p < 0.001$), while sampling time had no significant effect ($p > 0.05$). The highest microbial load was observed in raw milk, whereas microbial counts decreased markedly after pasteurization and fermentation. Increased microbial counts were observed in the later stage of the processing line (farm tank), indicating possible post-pasteurization contamination. Storage temperature and storage duration significantly influenced microbial growth ($p > 0.05$), with higher temperatures accelerating spoilage. Bacteria that remained in the filling stage of drinking yogurt were growing during storage conditions. Those remaining bacteria were identified and further confirmed as *Lactobacillus bulgaricus*, *Lactobacillus casei*, *Streptococcus thermophilus*, *Bacillus cereus*, *Staphylococcus spp*., *Staphylococcus epidermidis, Streptococcus spp., Streptococcus lactis, Brucella spp.,* and *Acinetobacter calcoaceticus*. Thus, a suitable update to the processing line was essential to destroy these bacteria and to avoid secondary contamination of the product. Further, following proper storage conditions throughout the value chain can minimize bacterial growth and thereby increase the shelf life of drinking yogurt. Thus, this study highlights the importance of strict hygiene practices and maintaining storage temperatures (2–4°C) to improve the microbiological safety and extend the shelf life of drinking yogurt.

Keywords: bacterial identification, dairy processing, fermentation, post-pasteurization contamination, spoilage microorganisms, storage temperature, Total Colony Count (TCC)

DEVELOPMENT AND EVALUATION OF CORNCOB-BASED MUSHROOM SUBSTRATE MEDIUM FOR SUSTAINABLE AMERICAN OYSTER MUSHROOM (*Pleurotus* spp.) PRODUCTION

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The American white oyster mushroom (*Pleurotus ostreatus*) is widely cultivated due to its rapid growth, high productivity, and adaptability. But rising costs and limited availability of quality sawdust have driven interest in alternative substrates. Agricultural residues such as corn cobs offer a sustainable and cost-effective option. This study evaluated the suitability of crushed corn cobs as an alternative substrate component for the cultivation of *Pleurotus ostreatus* under local conditions. Five substrate formulations were tested: T1 (Sawdust 100%), T2 (Corncob 25% + Sawdust 75%), T3 (Corncob 50% + Sawdust 50%), T4 (Corncob 75% + Sawdust 25%), and T5 (Corncob 100%). Growth and yield parameters, including mycelial growth rate, days to complete pinhead initiation, number of fruiting body development and effective fruiting body development, fresh weight, dry weight, cap diameter and stem thickness, were observed across three flushes. Data were analyzed using SPSS; one-way ANOVA followed by Tukey's HSD test at 5% significance level. Results indicated that mycelial growth and yield performance varied significantly ($p < 0.05$) among the different corncob-based substrate formulations. The fastest substrate colonization was observed in T2. The shortest duration for pinhead initiation and fruiting body development was recorded in T3 ($p < 0.05$). The highest fresh yield was also obtained from T4($p < 0.001$) and it is significantly different from the other 4 treatments. The highest dry weight was obtained by T5(mean= 64.00±17.29 g). In both morphological features, stable performance was shown by T3. Overall, substrate formulations containing crushed corn cobs demonstrated comparable or superior performance to the conventional sawdust substrate in terms of growth rate and productivity. In conclusion, crushed corn cobs can be effectively utilized as a sustainable alternative substrate component for *Pleurotus ostreatus* cultivation, with the T3 formulation showing the most promising results under the conditions of this study.

Keywords: agricultural waste utilization, edible mushroom, mushroom cultivation, *Pleurotus ostreatus*, sawdust alternative, substrate formulation

EVALUATION OF GRAIN LEGUMES AS BIOLOGICAL SOIL CONSERVATION MEASURES IN SLOPING LANDS UNDER ANNUAL CROP CULTIVATION

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Intensive annual crop cultivation on the steep slopes of Sri Lanka's central highlands generates over 70% of the nation's domestic supply but triggers severe soil erosion and nutrient depletion. Polyethylene mulches and structural controls are financially inaccessible and environmentally unsustainable for resource-poor smallholders. This study evaluated the potential of short-duration grain legumes as low-cost biological conservation alternatives to minimize erosion and preserve soil fertility. A field experiment was conducted using a Randomized Complete Block Design with three replications at the Natural Resources Research and Soil Conservation Demonstration Unit, *Kundasale* (40% slope). The field experiment was started from May 2025 and continued with laboratory analysis up to March 2026 and monitored soil response across six rainfall events. Treatments included two Green gram varieties (MIMB 7, MI 6), Black gram, and a bare land control. Soil properties (pH, EC, available phosphorus (P), available potassium (K), and organic matter (OM)) were monitored following rainfall events and analyzed using standard laboratory methods. Data analysis was done using GLM procedure in SAS. The bare land control suffered rapid degradation and nutrient stripping due to unshielded rainfall. Conversely, leguminous treatments successfully stabilized the soil chemical profile by reducing surface runoff and anchoring topsoil. Genotypic variations significantly influenced conservation efficiency. Green gram MIMB 7 and MI 6 varieties performed significantly better than other treatments ($P < 0.05$) due to rapid canopy closure and efficient rooting, with MIMB 7 performed best retaining the highest available P (6.34 mg kg^{-1}), available K (41.63 mg kg^{-1}), and OM (1.31%), while MI 6 retained available P (5.42 mg kg^{-1}), available K (38.70 mg kg^{-1}), and OM (1.20%) by trial termination. In contrast, bare land control showed the highest acidification at pH 5.11 with the lowest nutrient retention of available P (4.53 mg kg^{-1}), available K (31.20 mg kg^{-1}) and OM (1.02%). Erosion reduction is inferred based on improved nutrient retention and vegetative cover and rooting by legumes. Results suggest that integrating fast-growing grain legumes like Green gram varieties MIMB 7 and MI 6 can serve as an eco-friendly, highly accessible strategy to mitigate highland erosion, enhance nutrient retention, and secure smallholder farming resilience.

Keywords: central highlands, land degradation, soil fertility, soil nutrient depletion

DEVELOPMENT OF A HYDROGEL SEED COATING ENRICHED WITH GIBBERELLIC ACID FOR EARLY GROWTH OF MAIZE (*Zea mays)*

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Climate stress, which is caused by erratic rainfall and soil crusting, reduces the amount of global staple yields. Maize (*Zea mays*) is vulnerable during the critical days of seed establishment. The objective of this research was to develop and evaluate a starch-based hydrogel seed coating to improve the germination and early seedling growth of Maize. Hydrogel matrices were formulated from locally sourced potato starch, carboxymethyl cellulose, and xanthan gum, then enriched with gibberellic acid (GA3). The GA3 acid concentrations were selected based on the previous studies. Maize seeds were dip-coated in the polymer mixture maintaining a constant velocity, followed by cross-linking in 5% $CaCl_2$ solution and air-dried for 48 hours. In vitro germination was conducted for fourteen days across four treatments, T1 (uncoated), T2 (hydrogel only), T3 (0.015% GA3), and T4 (0.03% GA3). In the germination study, uncoated seeds (T1) achieved 100% germination with the fastest emergence. Coated seeds showed an initial lag from the polymer barrier. Hydrogel alone (T2) reached 92.5% germination. Low concentration of GA3 (T3) supported optimal early vigor at 82.5%, while the high dose (T4) appeared to cause shoot toxicity, reducing germination to 25% with notable delays. A pot trial was conducted with a completely randomized design under two water regimes, including the previous treatments for each regime, well-watered at field capacity and drought conditioned at 70% moisture depletion. Plants from high concentrated GA3 coated seeds showed a low rate of germination, but the established plants survived well. Statistical analysis confirmed significant treatment effects on shoot length by day 21 ($p < 0.05$). Comparison of the seed-coating treatments under drought and normal watering conditions revealed a stronger effect under drought stress ($p = 0.001$) than under normal watering conditions ($p = 0.023$). These results indicate that hydrogel seed coating combined with GA3 significantly enhances plant tolerance to water deficit and improves performance under drought conditions.

Keywords: gibberellic acid, hydrogel, seed coating

FORMULATION AND EVALUATION OF A LOW-COST BANANA-BASED CULTURE MEDIUM FOR OYSTER MUSHROOM (*Pleurotus spp*.) CULTURING

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Mushroom cultivation depends on culture media for the growth and maintenance of fungal cultures. As conventional media are relatively expensive, the development of low-cost alternatives using agricultural waste materials can support sustainable mushroom production while promoting waste recycling. Present study aimed to formulate and evaluate a low-cost culture medium using overripe banana waste for oyster mushroom (*Pleurotus* spp.) culturing. Banana-based media were prepared using both banana infusion and banana powder. Dextrose and Sucrose were incorporated as supplementary carbon sources and Augmentin was added to reduce bacterial contaminations. Preliminary trials indicated that incorporation of banana powder altered the physical characteristics of the medium. Therefore, higher agar concentrations are added than the conventional fungal media (1.5–2.0%) to improve gel stability and facilitate mycelial growth. Six banana-based media: Banana Agar (BA – 10.0% banana infusion + 1.5% agar), Banana Dextrose Agar (BDA- 10.0% banana infusion + 1.5% agar + 1.0% dextrose), Banana Sucrose Agar (BSA- 10.0% banana infusion + 2.0% agar + 1.0% sucrose), Banana Powder Agar (BPA- 4.0% banana powder + 7.5% agar), Banana powder Dextrose Agar (BPDA- 3.0% banana powder + 4.0% agar + 3.0% dextrose), Banana Powder Sucrose Agar (BPSA- 3.0% banana powder + 4.0% agar + 3.0% sucrose) along with Potato Dextrose Agar (PDA) as control were tested. BPDA and BPSA failed to solidify properly and were excluded from culturing experiments. Oyster mushroom tissues were inoculated into two culture vessel types (petri plates and glass bottles), and mean colony diameter was measured daily for 14-day. One-way ANOVA was used to compare the mycelial growth among media, while an independent sample t-test was performed to compare mycelial growth between Petri plates and glass bottles. No significant effect ($p > 0.05$) of culture vessels on mycelial growth was observed. BPA and BSA showed comparatively higher mean colony diameter with no significant difference ($p > 0.05$) compared to PDA. The findings indicate that, particularly Banana Powder Agar (BPA) and Banana Sucrose Agar (BSA), have potential as sustainable and low-cost alternatives to conventional culture media for oyster mushroom culturing and laboratory applications.

Keywords: agricultural waste utilization, Augmentin, low-cost medium, mycelial growth, overripe banana, sustainable biotechnology

SORPTION KINETICS AND EQUILIBRIUM ISOTHERMS OF 4-NITROPHENOL ON PRISTINE AND AGED MICROPLASTICS IN AQUEOUS SYSTEMS

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Microplastics (MPs) have become emerging environmental pollutants due to their widespread occurrence, persistence, and ability to interact with organic contaminants in aquatic systems. Among these contaminants, 4-nitrophenol (4-NP) is a toxic organic compound commonly detected in industrial effluents and surface waters. This study investigated the sorption kinetics, equilibrium adsorption isotherms, and desorption behavior of 4-NP on pristine, UV-aged, and H_2O_2-aged polyethylene terephthalate (PET) microplastics in aqueous systems. Artificial aging of PET MPs was carried out using UV photo-oxidative treatment and chemical oxidation with hydrogen peroxide (H_2O_2). Surface characterization was performed using Fourier Transform Infrared Spectroscopy (FTIR). H_2O_2-aged PET MPs showed the highest degree of surface oxidation compared to UV-aged PET MPs. The carbonyl index values increasing from 0.835 for pristine PET MPs to 3.876 and 8.793 for UV-aged and H_2O_2-aged PET MPs, respectively, indicates the aging of the MP surface. Batch adsorption experiments were conducted at pH < 5 and room temperature to evaluate the adsorption kinetics and equilibrium behavior of 4-NP on PET MPs. The adsorption performance increased in the order of pristine PET MPs, UV-aged PET MPs and H_2O_2-aged PET MPs. The equilibrium adsorption capacity of 4-nitrophenol increased from 0.171 mg g^{-1} for pristine PET MPs to 0.321 mg g^{-1} for UV-aged PET MPs and 3.42 mg g^{-1} for H_2O_2-aged PET MPs, demonstrating that environmental aging enhanced the sorption capacity of PET MPs. Kinetic studies indicated comparable fitting of pristine PET MPs to both models, while adsorption onto UV-aged and H_2O_2-aged PET MPs was better described by the pseudo-second-order model, suggesting increased surface interactions due to aging. Equilibrium adsorption data were analyzed using Langmuir and Freundlich isotherm models. The Freundlich model generally provided a better fit for all PET MPs, suggesting the possibility of heterogeneous multilayer adsorption. Desorption studies revealed desorption percentages below 15% for all PET MPs, indicating strong retention of adsorbed 4-NP on the particle surfaces. The results demonstrate that environmental aging significantly alters the surface properties and adsorption behavior of PET microplastics, increasing their ability to adsorb and retain organic contaminants. These findings highlight the environmental threat of aged MPs as potential carriers and long-term reservoirs of pollutants in aquatic environments.

Keywords: adsorption, artificial aging, desorption, FTIR, microplastic, PET

FUNCTIONAL AND QUALITY CHARACTERISTICS OF PASTA DEVELOPED FROM WHOLE-GRAIN WHITE WATERLILY SEED (*Nymphaea pubescens* Willd.) AND AT 311 BROWN RICE FLOUR BLENDS

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The increasing demand for functional and gluten-free foods has promoted the utilization of underutilized, nutrient-rich plant resources in value-added food product development. This study aimed to investigate the functional and quality characteristics of gluten-free flour blends and whole-grain pasta developed using white waterlily seed flour (*Nymphaea pubescens* Willd.) and Neeroga AT-311 brown rice flour. Different composite flour formulations containing white waterlily seed flour and brown rice flour were evaluated for their functional properties, while pasta samples were assessed for cooking quality, color, texture, and sensory attributes using semolina pasta as the control. Moisture content of flour blends ranged from 12.70% to 13.40% with no significant differences ($p > 0.05$) among treatments. In contrast, ash content increased significantly ($p < 0.05$) from 0.61% in the control to 1.71% in the 100% brown rice flour formulation. Loose bulk density decreased from 0.81 to 0.59 gcm^{-3}, while Carr's index and Hausner ratio increased with flour substitution, indicating reduced flowability of composite flour blends. Significant variations ($p < 0.05$) were observed in pasta color, texture, and cooking quality among treatments. Sensory evaluation was conducted on the control sample and two selected pasta formulations that demonstrated acceptable cooking quality and texture characteristics during preliminary analysis. Significant differences ($p < 0.05$) were observed among treatments for appearance, aroma, flavour, texture, and overall acceptability. Among the composite flour formulations, pasta containing 50% white waterlily seed flour demonstrated the highest sensory acceptability with desirable quality characteristics. Consumer survey findings revealed positive perceptions and willingness to purchase white waterlily pasta products due to their perceived nutritional and health benefits. These findings indicate that moderate incorporation of white waterlily seed flour and brown rice flour has potential for the development of nutritionally enhanced gluten-free pasta products with acceptable quality and sensory characteristics.

Keywords: brown rice flour, composite flour, functional food, gluten-free pasta, white waterlily seed flour.

FORMULATION AND CHARACTERIZATION OF A WAFFLE PREMIX INCORPORATING LOCALLY SOURCED PUMPKIN FLOUR

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Increasing consumer demand for functional and convenient food products has encouraged the development of bakery products with improved nutritional and functional properties. This study was conducted to formulate and characterize a nutritionally enhanced waffle premix incorporating locally sourced pumpkin flour (PF). Five different composite flour blends (100% RWF, 100% WWF, 100% PF, 50:50 PF: WWF, and 75:25 PF: WWF) were characterized for physicochemical and functional properties and waffles were characterized for their physical, textural, and sensory properties. Data were statistically analyzed using one-way ANOVA, Tukey's post hoc test, and Pearson's correlation analysis *($p < 0.05$).* Results revealed that the moisture content varied significantly *($p < 0.05$)* in composite flour blends from 7.71-13.02%, while water absorption capacity ranged from 0.95 ± 0.07 ml g^{-1} in 100% refined wheat flour to 9.15 ± 0.07 ml g^{-1} in the 100% pumpkin flour. Pumpkin flour also has increased bulk density and yellowness (b* = 41.52 ± 0.18) in composite flour blends. The addition of pumpkin flour significantly ($p < 0.05$) increased the waffle weight from 36.88 ± 0.05 g to 47.38 ± 1.41 g in this study. The 50: 50 Pumpkin flour: Whole wheat flour (WW) blend formulation received the highest overall acceptability (7.03 ± 1.90) and texture scores (7.25 ± 1.54) based on sensory evaluation. Correlation analysis revealed that there is a strong positive relationship between moisture content and cohesiveness (r = 0.905), water absorption capacity and spread ratio (r = 0.913), and pH and cohesiveness (r = 0.939). A strong negative correlation was observed between pH and the hardness of the waffles (r = -0.968). In conclusion, the incorporation of pumpkin flour has the potential to be used as a replacer for refined wheat flour in waffles, with a 50:50 PF: WW formulation providing optimal balance between functionality and consumer acceptance.

Keywords: composite flour, *Cucurbita maxima*, functional bakery products, physicochemical properties, sensory evaluation, whole wheat flour.

ATMOSPHERIC DEPOSITION OF MICROPLASTICS IN URBAN AND SEMI-URBAN ENVIRONMENTS: QUANTIFICATION AND CHARACTERIZATION AT PERADENIYA AND COLOMBO, SRI LANKA

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Atmospheric wet deposition has been identified as a significant but understudied pathway for microplastic transfer to terrestrial surfaces, particularly in Sri Lanka. This study quantified and characterized microplastics deposited via rainfall at two contrasting sites in Sri Lanka: *Meewathura* Experimental Station, Peradeniya and the main campus premises, University of Sri Jayewardenepura, Nugegoda, Colombo. Samples were collected biweekly for the duration of four months, using standardized rain gauges. Sample preparation involved vacuum filtration, digestion, density flotation, and fluorescence staining. Particle counting was carried out under fluorescence microscopy and analyzed using ImageJ (v.1.54f) software. Polymer identification was performed by FTIR spectroscopy. Among the ten collected samples, detectable levels of microplastics were found only in four samples, with mean deposition rates of 105 particles/m²/day in Colombo and 48 particles/m²/day in Peradeniya. Granule shaped particles were dominant among the microplastic particles collected at Colombo (42%), while fragments prevailed at Peradeniya (42%). The <20 μm size fraction was most abundant at both sites. PP, PA-6, PE, PS, PVC, PET, CA, PMMA, PC and PU polymer types were detected. No statistically significant ($p > 0.05$) difference in deposition rates was found between sites ($p = 1.000$). A direct positive correlation was observed between microplastic particle counts and the daily rainfall. These findings establish the first quantitative baseline assessment for atmospheric microplastic wet deposition in Sri Lanka, indicating that precipitation is an active transfer vector for airborne microplastics in both urban and semi-urban environments.

Keywords: atmospheric deposition, microplastics, polymer composition.

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PRODUCTION OF NUTRITION RICH OYSTER (*Pleurotus ostreatus*) MUSHROOM SOUP CUBE USING AVAILABLE LOCAL MATERIALS

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Fresh oyster mushroom (*Pleurotus ostreatus*) is an economically important edible fungus, but its high moisture content and lack of a protective cuticle make it highly perishable, causing substantial postharvest losses. This study aimed to develop a soup cube from oyster mushrooms using locally available ingredients, addressing postharvest loss through value addition. Two sequential approaches were used, each with six treatments (0% control + five mushroom flour concentrations): Approach I (AI) screened a broad range (30 - 70%) over 59 days, Approach II (AII) was developed based on the findings of AI and refined to a narrow concentration 20-40% of mushroom flour with xanthan gum (0.2 g per 50 g batch) as a structural binder, monitored for 35 days; the shorter AII duration reflects its later, staggered start within the same project timeline not a deliberate design choice. Cubes were packaged in oil paper, oversealed with Al foil, and stored at ambient temperature in zip-lock bags and plastic containers to compare storage conditions. Bulk density increased significantly ($p < 0.001$) with mushroom concentration, and AII achieved better weight uniformity (CV < 5%) than AI. Total yeast and mold counts remained within the ICMSF limit (10^5 CFU/g) until Day 11 in AI and Day 18 in AII, indicating the practical microbiologically acceptable storage periods. Based on superior physicochemical and microbial performance, AII was selected for sensory evaluation, where 45 semi-trained panelists identified AII-T4 (35% mushroom flour) as the most acceptable formulation, with appearance the strongest predictor of acceptability ($\beta = 0.386$, $R^2 = 0.818$). Each 5 g serving of the optimal formulation (35% mushroom flour, 25% cassava flour, 40% vegetable and spice powder mix, and xanthan gum) delivers 16.8 kcal, 0.64 g protein, 0.35 g fiber, and 118 mg sodium, an 85 - 90% reduction compared to conventional bouillon cubes, demonstrating a viable, consumer-acceptable, reduced-sodium functional food that remained microbiologically acceptable for up to 18 days under ambient storage Conditions.

Keywords: bouillon cube, functional food, postharvest loss, sensory evaluation, sodium reduction, storage stability

SUSTAINABLE VALORIZATION OF RICE HUSK FOR DEVELOPING A SILICON SUPPLEMENT TO ENHANCE GROWTH AND YIELD OF PADDY (*Oryza sativa* L.)

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Rice husk is a silica rich agricultural byproduct with considerable potential for the development of sustainable silicon (Si) based agricultural inputs. This study aimed to develop a stable rice husk derived orthosilicic acid ($Si(OH)_4$) solution and evaluate its effects on the growth and yield performance of rice (*Oryza sativa L*). Silica (SiO_2) was extracted from rice husk ash through alkali fusion using potassium hydroxide (KOH), followed by acidification with phosphoric acid (H_3PO_4) to produce a stabilized orthosilicic acid formulation. The synthesized materials were characterized using gravimetric analysis, UV-vis spectroscopy, Fourier transform infrared spectroscopy, and X-ray diffraction analysis. The final bulk formulation contained 4750 ppm silicon with a pH of 4 and was subsequently evaluated in a pot experiment using the rice variety Ld 253 under a completely randomized design comprising five treatments (0, 200, 300, 400, and 4750 ppm Si) with five replicates. Growth and yield parameters, including plant height, tiller number, productive panicle number, and grain weight, were assessed and statistically analyzed. Characterization results confirmed the successful synthesis of a plant available silicon product, with UV-vis spectroscopy showing a maximum absorbance at 804 nm and X-ray diffraction analysis indicating the presence of semi-crystalline SiO_2. Silicon supplementation significantly enhanced rice growth and yield compared with the control treatment. The observed improvement may be attributed to the role of silicon in strengthening plant tissues, improving stress tolerance, enhancing photosynthetic efficiency, and promoting more efficient nutrient utilization, resulting in increased plant height, tiller production, productive panicle number, and grain weight. Among the tested concentrations, 300 ppm Si produced the highest overall performance, resulting in a mean improvement of approximately 35% across measured parameters. The greatest relative response was observed for grain weight, which increased by approximately 51wt% compared with the control experiment. In contrast, application of the undiluted bulk 4750 ppm stock solution caused phytotoxic effects and reduced plant performance. The developed rice husk derived formulation represents a low cost Si–K–P nutrient source with potential application as a sustainable silicon supplement for rice cultivation.

Keywords: orthosilicic acid, rice growth, silicon nutrition, sustainable agriculture, yield enhancement.

EFFECT OF LIGHT SPECTRUM AND PACKAGING MATERIAL ON CURCUMIN DEGRADATION UPON STORAGE

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Curcumin, the major bioactive compound in turmeric (*Curcuma longa*), is highly sensitive to light exposure, which can reduce its stability during storage. This study evaluated the effect of different light spectrum and packaging materials on curcumin degradation. Curcumin was isolated from turmeric powder using solvent extraction and purification methods and characterized using Fourier Transform Infrared (FTIR) and UV–Visible spectroscopic analysis. The isolated curcumin samples were exposed for 3 hours to ultraviolet (UV) light, visible light and direct sunlight under three packaging conditions: aluminum foil, low-density polyethylene (LDPE) and direct exposure without packaging. A non-exposed control sample was maintained under dark conditions without light exposure for comparison. Following exposure, samples were analyzed using UV–Visible spectrophotometry at 421 nm and absorbance changes were used to assess degradation based on the Beer–Lambert Law. Three replicates were prepared for each treatment and statistical analysis was carried out using one-way Analysis of Variance (ANOVA) followed by Tukey's post-hoc test at a 95% confidence level. Significant differences among treatments were observed ($p < 0.05$), confirming that both light spectra and packaging materials influenced curcumin stability. Direct sunlight exposure without packaging showed the highest degradation with lowest absorbance values, while aluminum foil packaging demonstrated the highest protective effect by maintaining absorbance values closest to the control sample. LDPE provided moderate protection against degradation. Tukey's post-hoc analysis confirmed a progressive increase in curcumin degradation under the following light–packaging combinations: Control ≈ Visible–Al > UV–Al ≈ Sunlight–Al > Visible–LDPE > Visible–direct ≈ UV–LDPE > Sunlight–LDPE > UV–direct > Sunlight–direct. So, the study demonstrated that appropriate packaging and reduced light exposure are essential for preserving curcumin stability during storage.

Keywords: Beer–Lambert law, FTIR, photodegradation, storage stability, turmeric, UV–Visible spectrophotometry

ASSESSMENT OF ALTERNATIVE ASEPTIC CONDITIONS FOR *ALOE VERA* MICROPROPAGATION: EFFECTS ON CALLUS INDUCTION AND CULTURE CONTAMINATION

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Microbial contamination and inadequate sterilization infrastructure are critical constraints in *Aloe vera* tissue culture. This study optimized callus induction protocols for *Aloe barbadensis* by comparing the Seesap / CSUP method (Chemical Sterilization Using Sodium Hypochlorite), a low-cost alternative aseptic method, against conventional Laminar Airflow Cabinet (LAF)-based sterilization at the Department of Urban Bioresources, Faculty of Urban and Aquatic Bioresources, University of Sri Jayewardenepura. A factorial design was applied using full-strength and half-strength Murashige and Skoog (MS) medium, two 2,4-D concentrations (1.0 and 2.0 mg L^{-1}) with 6-Benzylaminopurine (BAP) fixed at 2.0 mg L^{-1}, and two vessel types (glass bottles and petri dishes). Leaf base explants were surface-sterilized using 1–2% NaOCl and cultured on MS agar medium. Contamination, survival, browning, and callus induction frequency were recorded at 5–7-day intervals over a 28-day observation period. Statistical analyses employed independent t-tests and two-way ANOVA. The CSUP method reduced contamination by 25–50 percentage points across all eight treatment combinations compared with the LAF method (binomial $p = 0.004$). Full MS + CSUP + glass bottle cultures achieved the lowest contamination rates. Full-strength MS bottle cultures recorded the highest survival rate (66.7%) and lowest overall contamination (26.7%), while half-strength MS petri dish cultures showed contamination up to 75%. Bottle cultures demonstrated a statistically significant survival advantage over petri dish cultures ($\chi^2 = 6.667$, $p = 0.010$). Browning was prevalent in NaOCl-treated cultures (71.4–76.9%), with earlier onset (mean 3.2 days after culture) and elevated PPO activity (0.85 vs 0.61 OD_{420}/min/g FW) compared to CSUP-treated material. Early tracheary element differentiation with spiral wall thickenings, observed exclusively in CSUP explants at 14 days after culture, confirmed callus initiation potential. These findings validate the CSUP method as a scientifically defensible and cost-effective alternative to conventional tissue culture infrastructure.

Keywords: *Aloe vera*, CSUP method, callus induction, contamination control, micropropagation, MS medium

DEVELOPMENT OF AN IOT-BASED LANDSLIDE EARLY WARNING SYSTEM USING A DYNAMICS FACTOR OF SAFETY MODEL

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Landslides are a recurring geohazard in Sri Lanka's highland regions, causing loss of life and infrastructure damage each monsoon season, yet most at-risk communities rely on single-variable empirical rainfall thresholds that fail to represent a slope's true geomechanically state. This study developed a low-cost IoT-based landslide early warning system (LEWS) integrating a dynamic Factor of Safety (SF) model for real-time slope stability assessment. The system employed an ESP32 microcontroller with a nine-sensor network (rainfall, soil moisture, soil temperature, ambient temperature, humidity, wind speed, slope angle, ground vibration, and atmospheric pressure) and GPS-tagged SMS alerting via a SIM808 GSM/GPS module. The SF model extended the classical infinite slope framework to incorporate five driving stress components: gravitational shear, rainfall infiltration, moisture-dependent cohesion reduction, seismic vibration, and wind loading with effective cohesion dynamically adjusted as a linear function of measured soil moisture. SF values were classified into five risk tiers (Safe, Watch, High, Very High, Failure) at thresholds of 1.3, 1.1, and 1.0, triggering local (LED, buzzer, OLED) and remote (Wi-Fi cloud, GPS-tagged SMS) alerts at one-minute intervals. Laboratory evaluation across 611 acquisition cycles yielded a mean SF of 8.69 (range: 0.808–76.05); 96.07% of readings were classified Safe (SF ≥ 1.3), while the 3.93% non-safe alerts (7 Watch, 7 High, 6 Very High, 4 Failure) arose exclusively under imposed steep-slope (45°) and high-moisture (up to 100%) conditions, confirming correct five-tier escalation. Pearson correlation identified soil moisture as the dominant SF determinant ($r = -0.606$, $p < 0.001$), with an even stronger slope-angle effect ($r = -0.851$, $p < 0.001$) in controlled tests, where SF declined from 5.04 to 1.13 (sandy soil) and 4.91 to 0.96 (mixed soil) across 10–45°. At a cost of LKR 18,000–22,000, the system represents a feasible community-scale LEWS for Sri Lanka's landslide-prone highlands, pending field calibration for site-specific deployment.

Keywords: ESP32, factor of safety, internet of things, landslide early warning, multi-parameter monitoring, slope stability

DEVELOPMENT OF A NANOCELLULOSE-BASED FUNCTIONAL MATERIAL FOR WASTEWATER TREATMENT

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Industrial wastewater containing organic pollutants, dyes, nutrients, and suspended solids has become a major environmental concern worldwide. Conventional wastewater treatment methods and synthetic membranes often face limitations such as high cost, membrane fouling, and poor biodegradability. This study focused on developing a sustainable nanocomposite membrane (NM) for industrial wastewater treatment applications by incorporating cellulose nanocrystals (CNCs) extracted from agro-vegetable food waste into a chitosan–alginate matrix to fabricate an eco-friendly membrane. Cellulose was extracted from mixed agro-vegetable food waste through alkaline and bleaching treatments, followed by acid hydrolysis for CNC production. Chitosan was extracted from shrimp shell waste, and NM was fabricated using CNCs, chitosan, and commercially available alginate, with calcium chloride and citric acid employed as crosslinking agents. Characterization of NM was performed using FTIR, DLS, and SEM. The filtration performance of the membrane was evaluated using Chemical Oxygen Demand (COD), Electrical Conductivity (EC), Total Dissolved Solids (TDS), nitrate, phosphate, pH, and colour intensity. The cellulose and CNC yields were 19.34% and 37.49%, respectively. FTIR identified characteristic functional groups of NM, while DLS showed particle sizes near 100 nm, confirming the nanoscale nature of CNCs. SEM observations before and after treatment demonstrated effective pollutant retention and good membrane performance. The CNC-based NM demonstrated superior pollutant removal efficiency compared with membrane control and sand filtration systems. The highest nitrate removal efficiency achieved was 86.68%, together with reductions in TDS (30.16%), EC (30.22%), COD (42.15%), Phosphate (47.11%), and colour intensity (72.94%), with statistical analysis indicating significant differences among filtration treatments ($p < 0.05$). The improved treatment performance was attributed to the synergistic interactions among CNCs, chitosan, and alginate, which enhanced membrane stability, porosity, adsorption capacity, and hydrophilicity. The developed membrane shows strong potential as a low-cost, biodegradable, and environmentally sustainable alternative for industrial wastewater treatment.

Keywords: agro-vegetable food waste, cellulose nanocrystals, industrial wastewater treatment, nanocomposite membrane, waste valorization

Sustainable Management of Fisheries and Aquaculture

EFFECT OF DIETARY RED CHILLI (*Capsicum annuum*) SUPPLEMENTATION ON GROWTH PERFORMANCE AND COLOURATION OF GOLDFISH (*Carassius auratus*)

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Synthetic carotenoids such as astaxanthin are commonly used in ornamental fish feeds to enhance pigmentation; however, their high-cost limits accessibility for small and medium-scale producers. Red chilli (*Capsicum annuum*) contains natural carotenoids and bioactive compounds that may support fish growth and pigmentation. This study evaluated the effects of dietary supplementation with whole dried red chilli powder at inclusion levels of 0%, 3%, and 6% on the growth performance, colouration, and survival of goldfish (*Carassius auratus*). A 65-day feeding trial was conducted in triplicate using three fish per tank in a commercial ornamental fish farm in Sri Lanka. Fish had an initial mean body weight of 3.0 ± 0.5 g. Weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), and body colouration were assessed. Colour intensity was evaluated through digital image analysis of red channel intensity. One-way ANOVA revealed a significant effect of dietary treatment on weight gain ($p < 0.05$). Fish fed the 3% red chilli diet achieved the highest mean weight gain (7.25 ± 1.61 g), significantly greater than the control group (2.64 ± 1.65 g). The 6% treatment produced intermediate weight gain (4.09 ± 1.18 g) and did not differ significantly from the other treatments. Although SGR showed a numerical increase in the 3% treatment, differences were not statistically significant ($p > 0.05$). FCR was also unaffected by dietary treatment ($p > 0.05$). Survival remained at 100% in all groups. Fish receiving the 3% diet visually exhibited enhanced colouration; however, image-analysis results showed high variability, preventing definitive statistical confirmation. These findings suggest that dietary supplementation with 3% red chilli powder may improve growth performance while providing potential colour enhancement in goldfish. The relatively small sample size should be considered when interpreting the results.

Keywords: *Carassius auratus*, *Capsicum annuum*, red chilli, ornamental fish, growth performance, natural pigment

OPTIMIZING LARVAL NUTRITION IN GUPPIES (*Poecilia reticulata*): EFFECT OF FORMULATED FEED, ARTEMIA AND DECAPSULATED ARTEMIA CYSTS

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The guppy (*Poecilia reticulata*) is a commercially important, export-oriented ornamental fish species that generates a substantial portion of Sri Lanka's export revenue. Despite its economic importance, establishing optimal nutritional management during the critical nursery phase remains a major bottleneck for local ornamental farms. During this early stage, guppy fry are typically fed either live Artemia nauplii or decapsulated Artemia cysts; however, the high cost of these feed inputs poses a severe financial constraint. Therefore, this study evaluated and compared the guppy fry growth performance, survival and economic viability using a commercial formulated powdered feed (T1) as an alternative to decapsulated Artemia cysts (T2), and live Artemia nauplii (T3). The feeding trial was conducted over 4 weeks in a commercial ornamental fish farm, Padukka, Sri Lanka, comprising 900 guppy fry randomly distributed across nine replicate units (100 fry/replicate, 3 replicates/treatment) and fed six times daily ad libitum. Growth performance and survival were evaluated using a one-way ANOVA followed by Tukey's HSD post-hoc test ($p < 0.05$). Dietary treatments had a significant effect on weight gain ($p < 0.05$), establishing a clear performance hierarchy: live nauplii yielded the highest mean weight gain (0.554 ± 0.018 g), followed by decapsulated cysts (0.455 ± 0.050 g), while formulated feed produced the lowest outcome (0.199 ± 0.038 g). Fish length gain was also significantly influenced by diet ($p < 0.05$), with live nauplii (1.223 ± 0.051 cm) and decapsulated cysts (1.137 ± 0.115 cm) both significantly outperforming the formulated feed (0.870 ± 0.056 cm. Conversely, mean survival rates did not differ significantly across treatments ($p > 0.05$), ranging between 85- 95%. Economic analysis revealed an intense cost disparity; formulated feed was less expensive (Rs. 13/=) over the 4-week period followed by decapsulated cysts (Rs. 127.5/=) and live nauplii (Rs. 1416.7/=). In conclusion, live Artemia nauplii remain superior diet for weight and length gain and decapsulated artemia cysts seems an alternative for live artemia with comparable weight and length gain and reduced feed cost. Consequently, these findings necessitate the need for utilizing live artemia nauplii or decapsulated artemia cysts during the initial four weeks of nursery before transitioning to optimized formulated diets.

Keywords: *Poecilia reticulata*, larval nutrition, live Artemia, decapsulated artemia cysts, formulated feed, growth performance, feed cost-analysis

FROM INVASIVE SPECIES TO FOOD: COMPARATIVELY EVALUATING THE NUTRITIONAL QUALITY OF *Channa micropeltes* IN SRI LANKA

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The Giant Snakehead *(Channa micropeltes)* is an invasive fish found in Deduru Oya Sri Lanka, where it poses a significant threat to native fish species via predation and competition. This study comparatively evaluated the nutrient composition of *Channa micropeltes* against two other fish species, *Oreochromis niloticus* and *Channa striata*, to assess its nutritional suitability as a food fish and explore its potential utilization as an effective invasive species management measure. Nine specimens of each fish variety were collected from the Deduru Oya Reservoir and filleted, dried in an oven, and ground to powder form as composite samples for proximate analysis. All the samples were analyzed for crude protein, lipids, ash, using Kjeldahl procedure, Soxtec-hot extraction, muffle furnace dry ashing, respectively and nitrogen free extract (NFE) by calculating the difference. One way ANOVA followed by Tukey's multiple comparison test was performed for the data analysis. Significant differences were observed among the three fish species for all proximate composition parameters evaluated on a dry matter basis ($p < 0.05$). The highest protein content was recorded in *Channa striata* (85.22 ± 0.09%), followed by *Channa micropeltes* (84.11 ± 0.12%), while *Oreochromis niloticus* exhibited the lowest protein content (79.89 ± 0.52%). Lipid content ranged from 5.11 ± 0.14% to 8.04 ± 0.16%, with *C. micropeltes* recording the highest lipid content among the studied species. Ash content was highest in *O. niloticus* (5.48 ± 0.22%), whereas NFE content ranged from 3.69 ± 0.26% in *C. micropeltes* to 7.93 ± 0.42% in *O. niloticus*. Overall, the findings demonstrate that *C. micropeltes* possesses a favorable nutritional composition characterized by high protein content comparable to *C. striata* and the highest lipid content among the species examined. These results indicate that *C. micropeltes* is a nutritionally suitable freshwater food fish and has potential for human consumption. Promoting its utilization may contribute to food security and additional income to the fishermen while supporting sustainable management of invasive fish populations through increased harvesting.

Keywords: invasive species, freshwater fisheries, proximate composition, Giant Snakehead, Common Snakehead, Tilapia, *Channa micropeltes*

ASSESSING THE ECONOMIC FEASIBILITY OF MUD CRAB (*Scylla serrata*) FATTENING IN VERTICAL RECIRCULATING AQUACULTURE SYSTEMS IN PUTTALAM, SRI LANKA: INFLUENCE OF INITIAL BODY WEIGHT AT STOCKING

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Mud crab fattening is a high-value aquaculture activity because hard-shell, full-meat crabs receive premium prices in local and export markets. This study assessed the growth and economic performance of three initial size classes of mud crab (*Scylla serrata*) fattened in an individual-box vertical culture system with a recirculating aquaculture system (RAS) in Puttalam, Sri Lanka. Thirty crabs were stocked in three size classes: Large (500–700 g), XL (700–900 g), and XXL (>900 g), with ten crabs per class. Culture durations were 19 days for Large, 24 days for XL, and 32 days for XXL crabs. Growth performance, water quality, feed use, full-cost profitability, benefit-cost ratio (BCR), and return on investment (ROI) were analysed using farm inventory records. Large and XL crabs recorded 90% survival, while XXL crabs recorded 80% survival. Mean final body weight was 642.00 ± 51.76 g in Large crabs, 842.22 ± 67.63 g in XL crabs, and 1113.00 ± 148.07 g in XXL crabs. Mean weight gain was 22.89 ± 15.61 g, 23.11 ± 18.08 g, and 38.00 ± 15.82 g for Large, XL, and XXL classes, respectively. One-way ANOVA indicated that mean weight gain did not differ significantly among size classes ($p > 0.05$). Daily water quality remained stable, with mean temperature 26.66 ± 0.45 °C, pH 8.23 ± 0.05, dissolved oxygen 7.24 ± 0.48 mg L^{-1}, salinity 22.27 ± 0.74 ppt, and ammonia remained below the detection resolution of the test kit (<0.5 mg L^{-1}). Full-cost analysis, including seed, feed, testing, chemicals, rent allocation, and electricity, showed positive profitability in all classes. XXL crabs yielded significantly higher net profit (LKR 56,205.17) and numerically higher BCR (2.51), While XL crabs also showed strong financial viability characterized by a 90% survival rate and a shorter culture cycle than XXL crabs. Considering profitability, survival, culture duration, and working-capital exposure together, XL crabs are recommended as the most balanced routine stocking class, while XXL crabs can be used strategically when premium market demand and capital availability are strong.

Keywords: aquaculture economics, survival, vertical box culture, full-cost profitability, benefit-cost ratio, return on investment

OCCURRENCE OF MICROPLASTICS IN COMMERCIAL AND FARM-MADE AQUACULTURE FEEDS USED FOR DIFFERENT AQUACULTURE SPECIES IN SRI LANKA

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Microplastic contamination in aquaculture feeds is an emerging concern for aquaculture sustainability and food safety. This study evaluated the abundance and characteristics of microplastics in commercial and farm-made feeds used for aquaculture species at different life stages (fry, fingerling, and adult) in Sri Lanka. A total of 15 feed samples were collected from commercial suppliers and local farms. Microplastics were extracted from 15 aquaculture feed samples in triplicate from 20 g feed samples using alkaline digestion (10% KOH and 30% H_2O_2), followed by density separation with saturated NaCl solution. The recovered particles were subjected to hexane treatment, vacuum filtration (2.5 µm cellulose membrane filters), Nile Red staining, and stereomicroscopic examination. Microplastics were manually counted and characterized based on their shape (fragments, fibers, and films), color, and size, while procedural blanks and contamination control measures were maintained throughout the analysis. Microplastics were detected in all feed samples, with abundances ranging from 0.90 to 34.50 particles g^{-1} feed (mean 11.52 ± 9.48 particles g^{-1} feed). Farm-made feeds showed higher contamination (21.50 particles g^{-1} feed) than commercial feeds (10.81 ± 9.38 particles g^{-1} feed). Among feed categories, food fish feeds contained more microplastics (12.28 ± 10.09 particles g^{-1} feed) and fingerling feeds had the highest abundance (16.58 ± 4.15 particles g^{-1} feed). Morphological analysis showed that fragments were predominant (85.68%), followed by fibers (10.01%) and films (4.31%). Black-color was the most predominant color among fish feed microplastic concentration and microplastics <500 µm was the most prevalent size variation in fish feed, accounting 48.33% of the total particles. This study provides the first evidence of microplastic contamination in Sri Lankan aquaculture feeds and highlights the need for improved monitoring and mitigation strategies to safeguard aquaculture sustainability and food safety.

Keywords: microplastics, aquaculture feed, Sri Lanka, feed contamination, farm-made feed, commercial feed, life stage

ISOLATION AND CHARACTERIZATION OF NATIVE BACTERIAL SPECIES FOR THE REMOVAL OF SELECTED POLLUTANTS FROM WASTEWATER

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Hotel wastewater is recognized as a complex matrix containing high loads of organic contaminants that pose significant risks to aquatic ecosystems and receiving water bodies. In this context, biological treatment approaches, particularly microbial bioremediation, offer a sustainable and cost-effective alternative to conventional physicochemical treatment methods. This study aimed to isolate, characterize, and evaluate indigenous bacterial strains capable of degrading organic contaminants in hotel wastewater, with particular emphasis on oil and grease, anionic surfactants, and microplastics. Bacterial isolates were obtained from a polluted water source using serial dilution techniques followed by streak plate purification. Morphologically distinct colonies were selected based on phenotypic characteristics. Preliminary identification using Gram staining and culture on MacConkey agar indicated that the majority of the isolates were Gram-negative bacteria. A total of nine morphologically distinct bacterial isolates were recovered, indicating substantial microbial diversity in the sampling environment. The biodegradation potential of the isolates was assessed under laboratory conditions for their ability to degrade selected pollutants. Quantification was performed using spectrophotometric analysis and weight loss calculations over a 14-day incubation period. No measurable degradation was observed for the microplastics. Among the tested isolates, L13, L31, and L14 exhibited the highest biodegradation efficiencies for oil and grease, achieving approximately 77%, 76%, and 74% respectively. For anionic surfactants, L11 and L31 demonstrated the highest biodegradation efficiencies, achieving approximately 70%. For both oil and grease and anionic surfactants, L11 (68.18% and 70.54%) and L31 (76.00 % and 70.49%) exhibited relatively high biodegradation efficiencies. Statistical evaluation using two-way ANOVA confirmed that bacterial isolate type, incubation time, and their interaction significantly influenced biodegradation performance ($p < 0.05$). Overall, the findings demonstrate that bacteria derived from polluted aquatic environments possess strong potential for application in the bioremediation of hotel wastewater. However, further optimization is required to enhance treatment efficiency in large-scale application.

Keywords: bioremediation, hotel wastewater, oil and grease, anionic surfactant

SIMULTANEOUS REMOVAL OF Pb(II), Cd(II), AND TEXTILE MICROFIBERS USING ALGINATE - CHITOSAN BIOPOLYMER MEDIA: ADSORPTION KINETICS AND ISOTHERM MODELLING

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The discharge of textile wastewater containing heavy metals and microfibers has become a significant environmental concern due to its toxicity and adverse effects on aquatic ecosystems. This study aimed to develop and evaluate a biodegradable dual-crosslinked alginate–chitosan adsorbent for the simultaneous removal of Pb(II), Cd(II), and textile microfibers from aqueous solutions. Alginate–chitosan beads were prepared using 2% (w/v) calcium chloride as an ionic crosslinking agent and 2% (w/v) citric acid as a covalent crosslinking agent. Different polymer volume ratios were evaluated, and the 9:1 alginate–chitosan formulation was selected as the optimum composition based on its structural stability. The prepared beads were characterized using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and swelling studies. FTIR analysis confirmed successful ionic and covalent crosslinking while preserving functional groups responsible for adsorption of Pb(II) and Cd(II). SEM analysis revealed a rough and heterogeneous surface morphology favorable for adsorption and microfiber entrapment. Swelling studies demonstrated pH-responsive behavior, with maximum stable swelling observed at pH 11. Adsorption experiments were conducted using Atomic Absorption Spectroscopy (AAS) to evaluate the effects of adsorbent dosage, initial metal concentration, contact time, and pH on removal efficiency. Pb(II) removal efficiencies exceeded 90%, while Cd(II) removal efficiencies ranged from 40–60%. Cd(II) removal increased significantly from approximately 52.5% at pH 7 to 96.3% at pH 11. Isotherm analysis indicated that Cd(II) adsorption was better described by the Freundlich model, suggesting adsorption on a heterogeneous surface, while kinetic studies showed good agreement with the pseudo-second-order model, indicating chemisorption as the dominant adsorption mechanism. The porous hydrogel structure effectively entrapped microfibers, and reusability studies demonstrated the regeneration potential of the beads, particularly for Cd(II). These findings demonstrate that dual-crosslinked alginate–chitosan beads are a promising biodegradable material for treating textile wastewater containing both heavy metals and textile microfibers**.**

Keywords: alginate-chitosan beads, dual crosslinking, heavy metals, textile wastewater

ACTIVATED SLUDGE MICROFAUNA AS COMPLEMENTARY BIOINDICATORS FOR COD AND BOD ASSESSMENT

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Activated sludge microorganisms play a key role in the degradation and stabilization of organic pollutants in biological wastewater treatment systems and respond rapidly to changes in operational conditions. This study evaluated activated sludge microfauna as supplementary bioindicators for assessing five-day biochemical oxygen demand (BOD_5) and Chemical Oxygen Demand (COD)-based treatment performance at the NWSDB wastewater treatment plant in Moratuwa/Rathmalana, Sri Lanka. Wastewater and sludge samples (n = 60) were collected from the inlet, aerobic tank, and outlet points of the wastewater treatment plant between January and May 2026 (20 sampling events × 3 sampling locations). Physicochemical parameters (BOD_5, COD, SV_{30}) were analyzed using standard methods, while microfauna were identified and quantified using light microscopy and Sedgwick-Rafter counting. Dominant groups included flagellates, amoebae, ciliates (free-swimming, crawling, and stalked), rotifers, nematodes, and filamentous organisms. High BOD_5 and COD levels were associated with increased abundance of flagellates and amoebae, indicating young and unstable sludge conditions. In contrast, stalked ciliates and rotifers were linked to lower organic loading and improved treatment stability, reflected by higher Sludge Biotic Index (SBI) values. Filamentous organisms showed positive associations with elevated SV_{30}, indicating poor sludge settleability. Correlation analysis showed significant positive relationships between flagellates and organic load parameters in the aerobic tank (BOD_5: $r = 0.957$, $p < 0.05$; COD: $r = 0.980$, $p < 0.05$), while SBI and attached ciliates showed negative correlations with pollution levels. These results confirm that microfaunal composition closely reflects wastewater quality and treatment efficiency. Overall, the study demonstrates that activated sludge microfauna can serve as effective supplementary bioindicators for assessing treatment performance and sludge stability. The proposed microbial indicator framework provides a simple and practical tool for operational monitoring of activated sludge systems.

Keywords: activated sludge, microbial bioindicators, BOD_5, COD, sludge biotic index, microfauna

ASSESSMENT OF RAINFALL AND WATER LEVEL FLUCTUATIONS ON THE CULTURE-BASED FISHERIES FISH PRODUCTION IN BOWATENNA RESERVOIR

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Culture-Based Fisheries (CBF) play an important role in inland fish production and rural livelihoods in Sri Lanka. However, fisheries sustainability in reservoirs is increasingly affected by rainfall variability, fluctuating water levels, and multipurpose reservoir operations. Therefore, this study assessed the impacts of rainfall, water level fluctuations on the culture-based fisheries fish production in Bowatenna Reservoir, Sri Lanka. Primary data on fish stocking and harvesting data from 2020–2026 and fishermen perception on rainfall water-level changes were collected through field observations and questionnaire surveys conducted among fishermen engaged in reservoir fisheries activities. Secondary data on monthly rainfall and reservoir water level data from 1999–2026 were collected from the Departments of Meteorology and Irrigation, respectively. The results revealed considerable temporal variability in rainfall and reservoir storage conditions within Bowatenna Reservoir. There was a shift in the rainfall peaks from November–December to October-November. Fish production also showed considerable temporal variation throughout the study period, with comparatively higher production observed during 2024 and 2025. Production peaks generally occurred several months after stocking activities, indicating the importance of suitable stocking timing and stable water retention conditions. Species-wise analysis showed that GIFT tilapia (*Oreochromis niloticus*) contributed the highest proportion to total fish production, suggesting greater adaptability under fluctuating reservoir conditions compared to Indian major carps. Fishermen reported that unstable water levels, sudden water releases, irregular rainfall patterns, and sedimentation negatively affected fishing activities and fish production. The study concluded that fisheries sustainability in Bowatenna Reservoir is strongly influenced by rainfall, reservoir water level and reservoir water management practices. Therefore, realignment of stocking and harvesting schedules, and improved coordination among fisheries and reservoir management authorities are essential for improving long-term fisheries sustainability.

Keywords: culture-based fisheries, Bowatenna reservoir, rainfall variability, water level fluctuations, fisheries sustainability, GIFT tilapia.

GREEN TOP-DOWN SYNTHESIS OF LIGNIN NANOPARTICLES FROM COCONUT COIR DUST: COMPARATIVE EVALUATION OF ULTRASONIC BATH AND PROBE SONICATION

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The valorization of agricultural residues into high-value nano products offers a sustainable strategy for waste management and the development of environmentally friendly agricultural inputs. This study aimed to extract lignin from coconut coir dust and synthesize lignin nanoparticles (LNPs) using environmentally friendly top-down sonication approaches. Crude lignin was recovered from coconut coir dust, an abundant agricultural by-product, via alkaline extraction and subsequent acid precipitation, achieving a recovery yield of 22.6% relative to the initial dry biomass weight. The recovered lignin was then subjected to sonication using a green top-down approach involving both ultrasonic bath and probe sonication to produce LNPs as a particle size reduction of lignin. To characterize the recovered lignin and synthesized LNPs, spectroscopic and light-scattering techniques were employed. The functional groups of the recovered lignin and LNPs were confirmed by Fourier-transform infrared spectroscopy (FTIR). Particle size analysis by dynamic light scattering (DLS) revealed that LNPs produced via ultrasonic bath sonication exhibited a Z-average hydrodynamic diameter of 266.4 nm with a polydispersity index (PDI) of 0.430, and LNPs produced via probe sonication exhibited a Z-average hydrodynamic diameter of 178.9 nm with a PDI of 0.737. Both sonication methods produced LNPs with particle sizes below 300 nm. However, ultrasonic bath sonication may offer greater potential for large-scale production due to its operational simplicity, lower energy intensity, and ability to process larger sample volumes simultaneously. Our results demonstrate that sonication-optimized coir-derived LNPs can serve as a sustainable, eco-friendly feedstock for biodegradable composites, thereby reducing agricultural waste.

Keywords: lignin nanoparticles, coconut coir dust, alkaline extraction, top-down synthesis

Aquatic Bioresources, Pollution and Microbial Ecology

ASSESSMENT OF WATER POLLUTION IN THE NEGAMBO LAGOON USING PLANKTON AS BIOINDICATORS

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Negombo Lagoon is one of the most ecologically and economically significant coastal lagoons in Sri Lanka. However, rapid urbanization, industrial discharge, domestic sewage disposal, and agricultural runoff have increasingly threatened the lagoon ecosystem through water pollution and eutrophication. Plankton are highly sensitive to environmental changes and therefore provide reliable information regarding the ecological condition of aquatic ecosystems. Hence, this study was conducted to assess the water pollution status of Negombo Lagoon using plankton communities as biological indicators. Water and plankton samples were collected from several selected locations within the lagoon representing different environmental conditions and human activities. Physico-chemical parameters including nitrate concentration was ranged from 0.407 to 0.753 mg/L, phosphate concentration was ranged from 0.022 to 0.070 mg/L, and Chlorophyll content ranged from 1.05 to 6.47 mg/L. These biological parameters were analyzed to evaluate water quality. Phytoplankton and zooplankton samples were identified and quantified using standard microscopic methods. The results revealed considerable spatial variation in water quality and plankton composition across the lagoon. Areas exposed to higher anthropogenic activities showed elevated nutrient concentrations, increased turbidity, and reduced dissolved oxygen levels. Several pollution-tolerant phytoplankton species such as Skeletonema spp. and Pseudonitzchia spp. were commonly observed in polluted regions, indicating eutrophic conditions. Zooplankton diversity was comparatively lower in highly contaminated areas, while tolerant species dominated under stressed environmental conditions. Commonly founded Zooplankton species were copepod nauplii spp . Correlation analysis demonstrated significant relationships between plankton abundance and selected water quality parameters, particularly nutrient concentration and dissolved oxygen levels. The findings of this study do not clearly confirm that plankton communities can effectively reflect changes in water quality and pollution status within Negombo Lagoon. The study highlights further suggestions for improving future research programs regarding this.

Keywords: Negombo Lagoon, Water Pollution, Plankton Bioindicators, Phytoplankton, Zooplankton

UTILIZATION OF LAKE WATER FOR GRASS AREA MAINTENANCE AT SOORIYAWEWA INTERNATIONAL CRICKET STADIUM: A CASE STUDY ON SUSTAINABLE AQUATIC RESOURCE MANAGEMENT

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The sustainable management of aquatic resources has become increasingly critical due to increasing water scarcity and the growing demand for sports facilities. This study examines the use of Meegahajandura Lake for grass maintenance at the Sooriyawewa International Cricket Stadium in Sri Lanka, highlighting the importance of sustainable water resource management for sports facilities. Despite the growing global acceptance of sustainable water management practices, the literature on the use of alternative and sustainable water resources for the maintenance of sports facilities in Sri Lanka and the South Asian region remains significantly limited. Therefore, the objective of this study is to investigate alternative and sustainable water management practices used at the Sooriyawewa International Cricket Stadium in Sri Lanka. A qualitative research approach was used for this study. Data were collected using structured interviews conducted with stadium staff of the Sooriyawewa International Cricket Stadium. Additionally, on-site observations were also used in validating the interview discussions. The findings revealed that about 100,000 liters of water are being used daily from the Meegahajandura Lake to maintain the grass areas of the Sooriyawewa International Cricket Stadium. Furthermore, the findings suggest that using lake water significantly reduces reliance on purified water supplies, thereby contributing to water conservation. The need to balance the maintenance of the stadium's grass area with the integrity of the aquatic ecosystems was identified as key considerations. The findings highlight the importance of establishing regulated extraction protocols and monitoring frameworks to ensure the long-term sustainability of the lake and the stadium. This case study contributes to the broader discourse on integrating natural aquatic resources into urban and semi-urban infrastructure management, providing practical insights for stadium authorities, environmental policymakers, and sustainability practitioners.

Keywords: water conservation, sustainable water management, sports facility management, Sooriyawewa international cricket stadium

MANGROVE SPECIES DIVERSITY AT REKAWA LAGOON, HAMBANTHOTA, SRI LANKA IN RELATION TO SOIL PHYSICOCHEMICAL PARAMETERS AND DISTANCE FROM THE SHORELINE

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Mangrove ecosystems have considerable ecological importance because of their potential contribution towards providing shoreline protection, carbon sequestration, biodiversity conservation, and fishery resources. In order to effectively conserve and manage mangrove ecosystems, it is necessary to take into account the environmental influences on the diversity of mangrove species. This study attempts to establish the relationship between mangrove tree diversity and the physico-chemical parameters of the environment like soil pH, soil salinity, soil organic matter, and distance to shoreline. Twenty random sampling plots of size 10×10 meters have been selected around the circumference of the lagoon. Adult and young mangrove tree species present within each plot were recorded and diversity estimated based on the Shannon–Wiener Diversity Index (H′). Soil samples from each plot were obtained and soil pH, salinity, and organic matter content determined. Multiple linear regressions and Spearman Rank Correlations were performed to investigate the relationships between environmental factors and mangrove diversity. In total, it is possible to distinguish ten species of mangroves that have been identified within the scope of the research. It proves that the lagoon is ecologically diverse. It is necessary to emphasize that the dominating species in the studied area is *Excoecaria agallocha*, which can be seen in all samples and which is quite adaptable. The study of the environmental factors proved the direct correlation between the diversity of species and the mentioned abiotic parameters, including salinity and soil pH, showing the impact of these environmental factors on the species composition. At the same time, when considering the species separately, it is possible to identify a number of interesting ecological correlations, for example, the direct correlation between *Avicennia marina* and salinity, showing the high tolerance of this species to salt content. Meanwhile, the inverse correlation between *Bruguiera gymnorrhiza* and the amount of organic matter indicates some special preferences in selecting habitat areas.

Keywords: mangrove diversity, shannon index, conservation, soil physical properties, soil chemical properties.

MICROPLASTICS IN WILD MUSSELS (*Perna viridis*) AND OYSTER (*Crassostrea madrasensis*): COMPARATIVE ASSESSMENT OF ACCUMULATION AND DEPURATION EFFICIENCY

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Microplastic (MP) contamination in bivalve molluscs is an increasing concern for marine ecosystems and human food safety. This study investigated MP contamination in wild *Perna viridis* (Asian green mussels) and *Crassostrea madrasensis* collected from Negombo Lagoon, Sri Lanka, with the objectives of evaluating the effectiveness of 24-hour commercial depuration, comparing MP abundance between species, characterising MP morphotypes, and assessing MP presence in lagoon water samples. Bivalve tissues were processed using hydrogen peroxide digestion, saturated NaCl density separation, and vacuum filtration through 2.5 µm cellulose membrane filters. Microplastics were identified using stereomicroscopy and confirmed with Nile Red fluorescent staining. Statistical analyses were performed. Results showed that depuration significantly reduced MP abundance from 2.66 ± 1.55 to 0.98 ± 0.85 particles/g wet tissue weight, representing a 63% reduction ($p = 0.030$). However, residual MPs remained after depuration, indicating that standard 24-hour purification cannot fully eliminate MP contamination. Before depuration, *Perna viridis* contained approximately 2.4 times higher MP abundance than *Crassostrea madrasensis*, although the difference was not statistically significant ($p = 0.078$). Two-way ANOVA revealed a significant effect of MP morphotype on abundance ($p = 0.001$), with fragments identified as the dominant type, and a significant interaction between species and morphotype ($p = 0.042$). Water samples from all three lagoon locations also contained MPs, predominantly fibers, with detected only at one site. Overall, the findings confirm that wild bivalves from Negombo lagoon are contaminated with MPs and highlight the need for improved depuration practices, and plastic waste control in Sri Lanka.

Keywords: Negombo lagoon, Sri Lanka, bivalve, food safety, morphotype.

IMMOBILIZATION OF INDIGENOUS FUNGAL ISOLATES ON ALGINATE FILMS FOR PARACETAMOL DEGRADATION IN WASTEWATER

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Pharmaceutical residues in aquatic environments represent a significant class of emerging contaminants, with paracetamol being one of the most widely detected compounds due to its extensive consumption and incomplete removal in conventional wastewater treatment systems. In Sri Lanka, existing wastewater treatment infrastructure is often insufficient to effectively remove low-molecular-weight pharmaceutical pollutants, necessitating the development of sustainable and efficient bioremediation approaches. This study investigates the potential of indigenous fungal isolates immobilized within alginate-based composite films for the degradation of paracetamol in aqueous systems. Seven morphologically distinct fungal isolates obtained from wastewater sources were screened for paracetamol tolerance and evaluated for their degradation potential under laboratory-controlled conditions. An alginate carboxymethyl cellulose (CMC) composite matrix was developed for fungal immobilization to enhance structural stability, operational durability, and applicability in wastewater treatment systems. All isolates demonstrated tolerance to low concentrations of paracetamol, indicating adaptability to pharmaceutical stress conditions. Among the isolates (fungus 1–fungus 7), fungus 2 exhibited the highest degradation efficiency, achieving approximately 40% paracetamol removal over a 10 day incubation period. The immobilization of fungal biomass within the optimized alginate CMC film significantly improved biomass retention and maintained fungal viability throughout the experimental period. Fourier Transform Infrared (FTIR) analysis confirmed successful integration of fungal biomass within the composite matrix and supported the suitability of the optimized formulation consisting of 2% sodium alginate and 1% CMC in a 3:1 ratio. The results demonstrate that immobilized fungal systems provide a stable and effective platform for enhanced biodegradation of pharmaceutical pollutants. Overall, the study highlights the promising application of indigenous fungal isolates immobilized in biopolymer based films for the removal of pharmaceutical contaminants from wastewater.

Keywords: pharmaceutical, alginate–CMC film, bioremediation, emerging contaminants, wastewater treatment

BRIDGING THE GAP: ASSESSING SRI LANKA'S LEGAL READINESS FOR THE BIODIVERSITY BEYOND NATIONAL JURISDICTION HIGH SEAS TREATY

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The Biodiversity beyond National Jurisdiction (BBNJ) Agreement, adopted under United Nations Law of the Sea (UNCLOS), provides an international legal framework for ocean governance in Areas beyond National Jurisdiction (ABNJ). Sri Lanka recently becomes a party to the BBNJ agreement but, faces significant challenges in implementing BBNJ provisions considering its dualist legal system. This study evaluates Sri Lanka's legal readiness to integrate BBNJ obligations by analyzing its existing domestic legal framework against the treaty's four core pillars: Marine Genetic Resources (MGRs) including Digital Sequence Information (DSI); Area-Based Management Tools (ABMTs) including Marine Protected Areas (MPAs); Environmental Impact Assessments (EIAs); and Capacity Building and the Transfer of Marine Technology (CB&TMT). Utilizing doctrinal legal analysis, comparative legal assessment, and gap analysis, the study identifies critical legislative gaps and recommendations. The findings indicate that to regulate MGRs and DSI, Sri Lanka must expand its National Policy and Strategies on Traditional Knowledge and Practices related to Biodiversity and the Access to Biological Material and Fair and Equitable Benefit Sharing Resources framework to encompass resources within ABNJ. It is better to designate the National Aquatic Resources Research and Development Agency (NARA) to manage a physical MGR bio-repository, establishing a dedicated national digital sequence database, and further need to designate inter-ministerial BBNJ committee as the national focal point for the Clearing-House Mechanism (CHM) and Access and Benefit-Sharing (ABS) processes. For spatial management under the ABMT pillar, the Marine Pollution Prevention Act No. 35 of 2008 and the Fisheries and Aquatic Resources Act No. 2 of 1996 must be amended to legally empower local authorities to propose and enforce high-seas protected areas, overseen by a newly formed inter-ministerial BBNJ committee. To satisfy the EIA pillar, the National Environmental Act No. 47 of 1980 requires modifications to insert mandatory chapters covering EIAs and Strategic Environmental Assessments (SEAs) for transboundary activities in ABNJ, utilizing the Central Environmental Authority (CEA) as the competent National Focal Point and formalizing transparent public consultation protocols. In conclusion, the present study is a baseline study that identifies the legal gaps to help effectively develop local regulations and policies aligned with BBNJ commitments to enhance Sri Lanka's ability to meaningfully contribute to global ocean governance and marine biodiversity conservation.

Keywords: biodiversity beyond national jurisdiction agreement, marine genetic resources, area-based management, capacity building.

DETECTION OF CYCLOSERINE AND LEVOFLOXACIN RESISTANT BACTERIA IN SELECTED MUNICIPAL SOLID WASTE DUMPSITES IN SRI LANKA: IMPLICATIONS FOR ANTIBIOTIC RESISTANCE SURVEILLANCE

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Tuberculosis (TB) remains a major global health challenge. Levofloxacin (LFX) and Cycloserine (CS) are two key second-line antibiotics for the treatment of drug-resistant TB. The global increase of antimicrobial resistance (AMR) poses a serious threat to public health, and poorly managed Municipal Solid Waste Dumpsites (MSWDS) can act as environmental reservoirs of Antibiotic-Resistant bacteria (ARB). This study aimed to identify the occurrence of LFX and CS resistant bacteria in two major MSWDS in Sri Lanka: Karadiyana and Meethotamulla. Bacterial isolates were obtained using the pour plate method on media supplemented with LFX and CS at a final concentration of 60 ppm. Morphologically different bacteria were isolated from the CS spiked plates. The minimum Inhibitory Concentration (MIC) of CS-resistant bacteria was determined using the agar dilution method according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. Total viable counts (TVC) of cultivable bacteria ranged from 4.53×10^5 to 16.9 × 105 CFU mL^{-1} in the sampling sites. None of the bacteria was grown against LFX, while the percentages of CS-resistant isolates ranged from 25.41–38.95% in Karadiyana and 75.21% in Meethotamulla. The antibiotic susceptibility test revealed that 50% of CS-resistant isolates showed MIC >360µg mL^{-1}, and 44% of isolates for 60-120 µg mL^{-1}. The multiple antibiotic resistance (MAR) index was calculated by exposing the CS-resistant isolates to LFX at 60µg mL^{-1}. None of the CSresistant isolates was resistant to LFX. Although resistance to LFX was not detected, it doesn't eliminate the potential risk of AR. These findings highlight the role of MSWDS as potential reservoirs of ARB and the need for molecular investigations. The results also highlight the importance of responsible antibiotic use and proper waste management strategies to prevent the environmental spread of AMR.

Keywords: antibiotic-resistant bacteria, Cycloserine, Levofloxacin, minimum inhibitory concentration.

DETERMINATION OF ANTIBIOTIC RESISTANCE AGAINST MOXIFLOXACIN AND CIPROFLOXACIN FOR ISOLATED TUBERCULOSIS (TB) -RESISTANT BACTERIA FROM SOLID WASTE

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Antimicrobial resistance (AMR) represents a critical global health challenge, with increasing concern over the emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) *Mycobacterium tuberculosis*. Environmental reservoirs, particularly solid waste, are increasingly recognized as potential sources of resistant bacteria and resistance determinants. This study investigated the antibiotic resistance patterns of tuberculosis (TB)-resistant bacteria isolated from solid waste in Sri Lanka against two key fluoroquinolones, Ciprofloxacin and Moxifloxacin. A total of 14 TB-resistant bacterial isolates were evaluated using the agar dilution method across a concentration range of 60–360 µg/mL. Minimum Inhibitory Concentrations (MICs) were determined, and the Multiple Antibiotic Resistance (MAR) index was calculated to assess resistance levels. At 60 µg/mL, 71.4% of isolates exhibited resistance to ciprofloxacin, while 57.1% were resistant to moxifloxacin. A subset of isolates demonstrated high-level resistance, maintaining growth even at the highest tested concentration (360 µg/mL). MAR index values ranged from 0.25 to 0.75, indicating varying degrees of multidrug resistance among isolates. Comparative analysis revealed a higher frequency of resistance to ciprofloxacin, suggesting greater environmental exposure and selective pressure. The persistence of resistant phenotypes at elevated antibiotic concentrations highlights the adaptive capacity of environmental bacteria and their potential role in sustaining fluoroquinolone resistance. These findings demonstrate that solid waste environments may function as reservoirs for fluoroquinolone-resistant bacteria, contributing to the environmental dimension of TB-related antimicrobial resistance. The study underscores the need for improved waste management strategies and further molecular investigations targeting resistance mechanisms, including mutations in *gyrA* and *gyrB* genes.

Keywords: antibiotic resistance, Tuberculosis, Ciprofloxacin, Moxifloxacin, solid waste, MIC & MAR

CHARACTERISTICS OF MICROPLASTICS AND THEIR AFFILIATED POLYCYCLIC AROMATIC HYDROCARBONS IN BEDDAGANA WETLAND, SRI LANKA

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Microplastic contamination is an emerging ecological concern in freshwater ecosystems due to its persistence and ability to adsorb hazardous pollutants such as polycyclic aromatic hydrocarbons (PAHs). Despite increasing global evidence of microplastic pollution in aquatic environments, information on the characteristics of microplastics and their affiliated Low Molecular Weight (LMW) PAHs in Sri Lankan freshwater wetlands remains limited. This study provides the first systematic investigation of the abundance, characteristics, polymer composition, and associated PAHs of microplastics in Beddagana Wetland, Sri Lanka. Water and sediment samples were collected from six sampling locations and analysed under two size categories: 5 mm -1 mm and <1 mm. Laboratory processing included wet sieving, oxidative digestion, density separation, and vacuum filtration. Microplastics were identified using stereomicroscopy, while polymer types were determined by Fourier Transform Infrared (FT-IR) spectroscopy and affiliated PAHs were quantified using High-Performance Liquid Chromatography (HPLC). Microplastics were detected at all sampling locations in both water and sediment samples, with sediments showing greater accumulation than water. Fibers and fragments were the dominant microplastic types, while blue-coloured microplastics were the most abundant. Smaller particles (<1 mm) were more prevalent, suggesting ongoing fragmentation of plastic debris within the wetland. Location 3 recorded the highest microplastic abundance in both water and sediment samples (130.00 ± 23.85 particles L^{-1} and 1541.67 ± 260.21 particles kg^{-1}), whereas Location 6 showed the lowest abundance. One-way ANOVA indicated significant spatial variation in microplastic abundance among locations. FT-IR analysis identified polyethylene (PE), polypropylene (PP), polyamide (PA), polyethylene terephthalate (PET), and polystyrene (PS). Low molecular weight PAHs associated with microplastics displayed location-specific distribution patterns, with phenanthrene and naphthalene being the most abundant compounds and the highest contamination detected at Location 1 in both water and sediment samples. These findings demonstrate that microplastics in Beddagana Wetland act as carriers of hazardous organic pollutants, posing potential ecological risks to the freshwater ecosystem.

Keywords: freshwater ecosystem, polymer identification, phenanthrene, naphthalene, FT-IR spectroscopy, HPLC

PURITY AND HEAVY METAL PROFILING OF KAPPA-CARRAGEENAN FROM *Kappaphycus alvarezii* SEAWEED FOR ECO-FRIENDLY EDIBLE FILM FORMULATIONS

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Kappa-carrageenan (kCA) is a major biopolymer derived from the red seaweed *Kappaphycus alvarezii*. It serves as a sustainable and biodegradable alternative to petroleum-based plastics, which contribute to environmental pollution and heavy metal accumulation in marine ecosystems. This study aimed to extract kCA using the thermal alkali extraction method and determine its purity by comparison with commercial standard carrageenan. Heavy metal intake, including chromium (Cr), arsenic (As), cadmium (Cd), and lead (Pb), was quantified using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Structural changes and thermal stability were determined using Fourier-transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA), respectively. The heavy metal concentrations in the extracted carrageenan were 0.200 ppm (Cr), 0.353 ppm (As), 0.033 ppm (Cd), and 0.257 ppm (Pb). The tested heavy metals were below the international safety threshold. This indicates negligible heavy metal toxicity and a low risk of bioaccumulation due to the presence of heavy metals in the extracted kCA. Additionally, kCA has the potential to become a safe, eco-friendly product useful in the development of food packaging; however, further validation is required to address any seasonal or geographical variations.

Keywords: kappa-carrageenan, Heavy metal, *Kappaphycus alvarezii*, edible film, biodegradable polymers.

Posters

AN NDVI-BASED ANALYSIS OF BEDDAGANA WETLAND PARK, COLOMBO, SRI LANKA (2014–2025) TO MEASURE CONSERVATION EFFICACY THROUGH VEGETATION RECOVERY

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Urban wetlands are undergoing rapid degradation due to urbanization, often beyond the reach of conservation interventions. Colombo was recognized as the world's first Ramsar Wetland City, and this study provides valuable evidence of effectiveness in urban wetland restoration as a contributor to the blue-green economy. It assessed vegetation recovery in Beddagana Wetland Park, an 18 ha protected freshwater wetland located in Sri Jayewardenepura Kotte, using multi-temporal Normalized Difference Vegetation Index (NDVI). Cloud-free Landsat 8 Collection 2 Level-2 Surface Reflectance images, which incorporate standard atmospheric correction, were manually selected for four key years representing different conservation phases: prior to protection (2014), park establishment (2016), early maturation (2021), and current conditions (2025), and processed using ArcGIS Pro. Results indicated a substantial increase in mean NDVI from 0.251 to 0.394 (56.9%), with a reduction in standard deviation from 0.070 to 0.050. This trend suggests increasing vegetation density, greater spatial homogeneity, and ecosystem maturation. The largest increase in NDVI (+0.061; +24.3%) occurred between 2014 and 2016, corresponding with initial restoration activities, with subsequent growth slowing to 16.0% (2016–2021) and 8.8% (2021–2025), consistent with ecological succession theory. These findings suggest that integrated governance, combining statutory authority, sustained funding, defined boundaries, and international recognition, may support wetland recovery within urban landscapes, thereby strengthening urban bioresources that underpin sustainable blue-green economies. This study has limitations: the 30 m resolution of Landsat 8 imagery is coarse relative to the 18 ha study area, the four-year sampling interval may not capture finer temporal variation, and no statistical significance testing was conducted on inter-annual NDVI differences. Future studies should incorporate higher-resolution Sentinel-2 data, more frequent temporal sampling, and appropriate statistical analyses to confirm observed trends.

Keywords: NDVI, Beddagana Wetland Park, remote sensing, wetland restoration, Ramsar Wetland City, blue-green economy

EFFECT OF PHENYLALANINE INCORPORATED BIOCHAR ON EARLY SEEDLING PERFORMANCE AND SOIL PROPERTIES UNDER MAIZE (*ZEA MAYS*) CULTIVATION

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Nutrient leaching reduces soil fertility and crop productivity, creating a need for effective soil amendments that enhance nutrient retention and improve the soil quality. This research aims to successfully synthesize phenylalanine-incorporated biochar and evaluate its combined effects on soil fertility and early plant growth. This study was conducted at the Faculty of Urban & Aquatic Bioresources, Kohuwala, Nugegoda. Biochar was produced under controlled pyrolysis. Crushed and sieved (< 2 mm) biochar was mechanically agitated with 0.05 M phenylalanine solution. Phenylalanine-incorporated biochar was synthesized and characterized using FTIR spectroscopy. The SEM image confirmed surface characteristics and the porous structure of biochar, while FTIR analysis confirmed the successful incorporation of phenylalanine into the biochar matrix. A pot trial was designed as a Completely Randomized Design (CRD) with five different treatments (T1= Control, T2= Only biochar, T3= Only Phenylalanine, T4= Phenylalanine incorporated biochar and T5=Recommended fertilizer) with three replications. The pot trial was conducted for 45 days. Within the experimental period plant height was measured weekly, while soil pH, EC and Potential Mineralizable Nitrogen (PMN) were measured after 3 weeks and after 6 weeks. Data were analyzed two-way ANOVA in Minitab 16. During the 45 days plant height did not show any statistical significance among the treatments ($p=0.053$). However, the highest mean plant height was observed in phenylalanine-incorporated biochar applied soil. In addition, the results showed that the soil pH was significantly affected by different treatments ($p = 0.015$). Soil EC ($p >0.05$) and PMN ($p > 0.05$) were not significantly affected by the treatments. The positive trend in plant height associated with phenylalanine incorporated biochar suggests its potential as an effective soil for enhancing plant growth.

Keywords: biochar, phenylalanine, soil fertility

DESIGN AND EVALUATION OF A BILINGUAL WEB-BASED AGRICULTURAL PRODUCT AVAILABILITY SYSTEM FOR IMPROVING FARMER–CONSUMER COMMUNICATION IN SRI LANKA

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The agricultural sector in Sri Lanka faces challenges related to limited market information, weak farmer–consumer communication, and dependence on intermediaries. Although several digital agriculture initiatives provide advisory and extension services, there is a lack of simple bilingual platforms that enable direct communication between farmers and consumers regarding agricultural product availability. Therefore, this study aimed to develop and evaluate a bilingual web-based agricultural product availability system named AgriAvail. The system was developed using the R programming language, R Shiny web framework, Google Sheets cloud database integration, and cloud-based deployment technologies. It enables farmers to upload agricultural product information and allows consumers to search available products through Tamil and English interfaces. System evaluation was conducted using Google Form surveys involving 43 respondents from Batticaloa District and 33 respondents from the Northern Province, including farmers, consumers, agricultural officers, and university students selected through purposive sampling. The collected data were analyzed using percentage analysis and mean score analysis. The results indicated positive user responses regarding system usability, accessibility, and direct farmer–consumer communication. More than 90% of respondents expressed positive acceptance of the system, while the overall usability mean score exceeded 3.8 out of 5. The findings demonstrate that the AgriAvail web application improves access to agricultural product information and strengthens localized agricultural communication. Overall, the study highlights the potential of lightweight digital technologies to support digital agriculture and improve farmer–consumer connectivity in Sri Lanka.

Keywords: agricultural information system, digital agriculture, farmer–consumer communication, rShiny, Sri Lanka

DESIGN AND OPTIMIZATION OF AN AUTOMATED PORTABLE INDOOR VERTICAL HYDROPONIC SYSTEM FOR URBAN LETTUCE CULTIVATION

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Rapid urbanization and climate variability have increased the need for sustainable indoor food production systems. The objective of the research was to design, optimize, and evaluate an automated portable indoor vertical hydroponic system through nutrient and light optimization of *Lactuca sativa* Le. The system employed an ESP32 microcontroller to automatically regulate temperature, humidity, and LED lighting duration. The experimental design was Randomized Complete Block Design (RCBD) with four replicates which optimizing through effect analysis, five Albert solution concentrations of (control) T_1: 0 gL^{-1}, T_2: 0.5 gL^{-1}, T_3:1.0 gL^{-1}, T_4: 1.5 gL^{-1} T_5: 2.0 gL^{-1} and four LED light conditions, including L0 (control): no artificial light, L1: one RGB LED panel, L2:one R/B LED panel, and L3: two R/B LED panels, were evaluated through two separate growing season using two factorial Completely Randomized Design (CRD) with 4 replicates per treatment. The number of leaves (NL), leaf length (LL), leaf width (LW), fresh weight (FW), dry weight (DW), and total chlorophyll content (TCC) were measured per plant. Statistical analysis was performed using one-way ANOVA and Tukey's test. In both seasons, nutrient and LED light treatments significantly improved lettuce growth and yield compared with the control ($p < 0.05$), while differences among nutrient treatments, excluding the control, were not significant. In Season 1, T_3 and L1 produced the highest FW (23.96 ± 3.53 and 21.80 ± 3.08 g, respectively) and DW (1.18 ± 0.18 and 1.06 ± 0.17 g, respectively), whereas L2 recorded the highest TCC (0.35 ± 0.04 mg g^{-1}). In Season 2, T_4 achieved the highest FW (26.88 ± 4.05 g) and DW (1.78 ± 0.23 g), while L3 recorded the highest FW (26.93 ± 2.85 g), DW (1.69 ± 0.21 g), and TCC (0.65 ± 0.26 mg g^{-1}). Overall, T_3 and L1 in Season 1, and T_4 and L3 in Season 2, were the most effective treatments. Both light and nutrient treatments were key drivers of improved lettuce performance, indicating effective optimization within the tested ranges in this vertical hydroponic system.

Keywords: hydroponics, indoor food production system, *Lactuca sativa,* RGB LED lighting

ASSESSMENT OF POLLUTION TOLERANCE OF PLANTS ON COLOMBO ROADSIDE TREES BASED ON AIR POLLUTION TOLERANCE INDEX (APTI), ANTICIPATED PERFORMANCE INDEX (API), PARTICULATE MATTER (PM) DEPOSITION AND ROADSIDE PERFORMANCE INDICATORS

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Urban air pollution has emerged as a critical environmental issue in rapidly urbanizing cities, posing significant risks to human health and ecological sustainability. Roadside vegetation plays a vital role in mitigating atmospheric pollution through the capture of particulate matter (PM) and tolerance to gaseous pollutants. This study evaluated the suitability of commonly occurring roadside plant species in Colombo, Sri Lanka, using the Air Pollution Tolerance Index (APTI), Anticipated Performance Index (API), particulate matter deposition capacity, and roadside performance indicators. Field surveys were conducted along low, medium, and high-traffic roadsides to identify the most abundant plant species. For that, data were collected from Bauddhaloka Mawatha, High-Level Road, Nugegoda, Rajagiriya–Battaramulla Road, Viharamahadevi Park road, Maradana railway station to Borella junction road, Townhall to public library road, along a 2.5 km distance. Based on species abundance, fifteen plant species were selected for detailed analysis. Biochemical parameters, including leaf extract pH, Relative Water Content (RWC), total chlorophyll content, and ascorbic acid content were measured to calculate APTI values. API was assessed using biological, morphological, and socio-economic characteristics, while PM deposition capacity was determined through gravimetric analysis. Roadside performance indicators such as canopy density, leaf damage, maintenance requirements, and overall plant health were also evaluated. A data analysis was conducted using descriptive statistics based on the mathematical equations of APTI and API. The results revealed significant variation among species in pollution tolerance and mitigation capacity. *Mesua ferrea* (23.2), *Mangifera indica* (19.5), *Filicium decipiens* (17.4), and *Samanea saman* (17.0) recorded high APTI values, indicating strong tolerance to urban air pollution. In contrast, *Plumeria obtusa* (4.1), *Saraca asoca* (6.8), and *Terminalia catappa* (8.8) were identified as sensitive species and potential bioindicators of pollution stress. High PM deposition capacities were observed in *Tectona grandis*, *Terminalia catappa*, and *Mangifera indica*, mainly due to their broad and rough leaf surfaces. API analysis identified *Mangifera indica* and *Samanea saman* as highly suitable species for roadside planting. The study demonstrates that integrating APTI, API, PM deposition, and roadside performance indicators provides a comprehensive framework for selecting effective urban roadside vegetation.

Keywords: bioindicators of air pollution, gaseous pollutants, roadside vegetation, urban air pollution

THE EFFECT OF AUDIBLE SOUND FREQUENCY WAVES ON THE GROWTH PERFORMANCE OF GREEN LETTUCE (*Lactuca sativa L.*) IN A HYDROPONIC CULTIVATION SYSTEM

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The increasing demand for sustainable, non-chemical agriculture has driven interest in audible sound waves as physical elicitors. Plants perceive sound vibrations through mechanosensitive ion channels, converting mechanical stimuli into biochemical signals that may influence vegetative growth. This study investigated the effect of three audible sound frequencies on the growth of green lettuce (*Lactuca sativa L.*) in a hydroponic cultivation system under controlled greenhouse conditions. Three independent ESP32-based acoustic systems, one at each frequency, generated sine waves at a fixed intensity of 50 dB, calibrated with a sound level meter and verified with an oscilloscope. Environmental parameters (temperature, humidity, light, and CO_2) were monitored and maintained uniformly. Four treatments were evaluated: a silent control, 300 Hz, 1000 Hz, and 3000 Hz, each applied for two hours daily (9:00-11:00 AM) over 28 days. Growth parameters, including leaf number, plant height (average growth rate), and leaf area (two representative leaves per plant), were measured weekly. Data were analyzed using one-way Analysis of Variance (ANOVA) followed by Dunnett's post-hoc test, and a Latinized Randomized Complete Block Design (RCBD) model incorporating period and greenhouse as blocking factors. The results showed no statistically significant treatment effects for leaf number ($F(3,32) = 1.666$, $p = 0.194$), average growth rate ($F(3,32) = 0.272$, $p = 0.845$), or leaf 2 area growth ($F(3,32) = 1.495$, $p = 0.235$). Leaf 1 area growth exhibited a borderline significant ANOVA ($p = 0.046$), but Dunnett's test found no individual treatment differing from the control, and the RCBD model confirmed no consistent treatment effect ($p = 0.507$). The ESP32 system operated reliably throughout the 28 days without frequency drift. Under tested parameters (300–3000 Hz, 50 dB, 28 days), audible sound waves showed no significant effect on lettuce growth. Future studies should test lower frequencies (50–150 Hz), higher intensities (70–100 dB), longer exposures with different waveforms, and replicate across multiple greenhouses to increase statistical power. The ESP32 platform provides a reproducible foundation for future bioacoustics research.

Keywords: acoustic stimulation, controlled environment agriculture, ESP32, urban farming, vegetative growth

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