SYMP 24'

PROCEEDINGS
1ST INTERNATIONAL SYMPOSIUM ON MICROPLASTICS POLLUTION

19TH SEPTEMBER 2024

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

Organized by

Board of Study in Environmental Science
Postgraduate Institute of Science (PGIS)
University of Peradeniya, Sri Lanka

PROCEEDINGS

1st International Symposium on Microplastics Pollution – SYMP 2024'

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Organized by the

BOARD OF STUDY IN ENVIRONMENTAL SCIENCE
POSTGRADUATE INSTITUTE OF SCIENCE (PGIS)
UNIVERSITY OF PERADENIYA, SRI LANKA
2024

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Message from the Vice-Chancellor
University of Peradeniya, Sri Lanka

It is with great pride that I send this congratulatory message and extend a warm welcome to all participants of the Symposium on Microplastic Pollution 2024 (SYMP 2024), organized by the Board of Study in Environmental Science of the Postgraduate Institute of Science (PGIS), University of Peradeniya. The symposium's theme is timely and crucial as the world increasingly recognizes the serious threat of microplastic pollution to our ecosystems, biodiversity, and human health.

The University of Peradeniya is deeply committed to contributing to the global effort to achieve the United Nations Sustainable Development Goals (SDGs). We have a dedicated webpage highlighting our ongoing efforts, with some of the goals closely aligned with the fight against microplastic pollution. Furthermore, the organization of the symposium-themed 'Microplastic Pollution 2024' emphasizes the university's efforts to combat microplastics.

The research on microplastic pollution addresses the widespread fields involving medicine, veterinary medicine, agriculture, and engineering, where the university can address the impact of plastics on ecosystems, human health, and agriculture.

I have full confidence that "SYMP-2024" will serve as a crucial platform for facilitating the sharing of knowledge, research, and cutting-edge solutions to combat microplastic pollution.

I sincerely thank the Director of the PGIS, the organizing team, and all staff members for meticulously planning this event with the norms and customs of the institution. I am positive that we can drive meaningful change in the battle against microplastic pollution through research, innovation, and policy.

I wish SYMP-2024 a great success.

Prof. Terrence Madhujith

Vice-Chancellor |University of Peradeniya

Message from the Director
Postgraduate Institute of Science (PGIS)
University of Peradeniya, Sri Lanka

The Postgraduate Institute of Science (PGIS) at the University of Peradeniya, Sri Lanka, is a leading institution committed to advancing scientific research and education. The Postgraduate Institute of Science offers a diverse range of postgraduate programmes, emphasizing research-based learning and providing ample opportunities for students and researchers to engage in cutting-edge studies. Additionally, the Institute organizes national and international conferences, workshops, and short courses.

It is with great pleasure that I welcome you to the Symposium on Microplastics Pollution (SYMP)-2024, organized by the Board of Study in Environmental Science at PGIS. SYMP-2024 serves as a platform for postgraduate students and renowned researchers to present their findings, engage in discussions, and exchange insights. The conference will cover various themes, including the detection and monitoring of microplastics in the environment, health risks associated with microplastics exposure, remediation measures and policies, and technological innovations. PGIS is an ideal setting for developing strategies to address microplastics pollution, focusing on source control, remediation, and cleanup. Together, we can make a significant impact both locally and globally.

Despite the high levels of microplastic pollution in developing countries, its environmental and health implications have not yet been fully communicated to the general public. I commend the Board of Study in Environmental Science for recognizing the seriousness of this issue and striving to raise awareness within society.

The successful realization of this Symposium is attributed to the unwavering dedication and relentless efforts of our esteemed colleagues. Our heartfelt appreciation goes to Symposium Chairperson Prof. Nadeeshani Nanayakkara, Dr. Nadeesha Koralegedara, Secretary of SYMP - 2024, Prof. Namal Priyantha, Chairman of the Board of Study in Environmental Science, and the entire organizing committee. We extend our sincere thanks to all the authors who have entrusted their work to this Symposium and offer our heartfelt congratulations to all the presenters who will share their insightful findings.

I hope all participants will engage in fruitful discussions about the future of this critical issue.

Prof. H.M.T.G.A. Pitawala

Director | Postgraduate Institute of Science | University of Peradeniya

Message from the Chairman, Board of Study in Environmental Science, Postgraduate Institute of Science (PGIS) University of Peradeniya, Sri Lanka

Microplastics Pollution – The Next Disaster in Ecosystems!

I am pleased to deliver a message to mark the Symposium on 'Microplastics Pollution', organized by the Board of Study in Environmental Science of the Postgraduate Institute of Science (PGIS), University of Peradeniya, enabling sharing the knowledge on the emerging issue of microplastics, their detection and potential challenges.

Plastics have many desirable properties from the industrial point of view; ability to obtain any shape with attractive colours, lightweight, durability, flexibility, and low-cost of production are some of them. Consequently, plastics have become an integral part of our everyday life – we drink water stored in plastic bottles; we purchase food items packed in plastic containers; our lunch is wrapped with plastic sheets or packed in plastic boxes; etc. When plastics break down, they form microplastics, which are 5.0 mm or less in length. Microplastics enter natural ecosystems from a variety of sources, including cosmetics, clothing, and industrial processes. Microplastics can further break down into even smaller pieces called nanoplastics, which are less than 1 μm in size, and hence, not visible to the naked eye – but can travel long distances. Microplastics have a high probability of ingestion, incorporation into, and accumulation in the bodies and tissues of many organisms, which would lead to health problems. Moreover, undesirable effects are even worse with nanoplastics. They would more easily penetrate tissues in living organisms, which could lead to toxicological effects. Another concern is that chemical pollutants, such as heavy metals and pathogens, may stick to nanoplastics and become concentrated in the environment.

Although microplastics/nanoplastics are associated with hazardous effects, there is no adequate attention, understanding or remedial measures taken on this incoming severe threat. Marine pollution due to microplastics/nanoplastics could be an alarming threat in the future for humans and other organisms fed on seafood.

With the development of technology, which is essential to meet the demand and the comfort of the population, production of plastics has been expanding. Nevertheless, let's minimize the ways and means of producing microplastics and nanoplastics – possible next environmental disaster. If humans protect the environment, the environment will protect humans!

Prof. Namal Priyantha

Chairman | Board of Study in Environmental Science | PGIS

Message from the Chairperson
1st International Symposium on Microplastics Pollution – SYMP 2024

As the chairperson of the Symposium on Microplastics Pollution, SYMP 2024, organized by the Board of Study in Environmental Science at the Postgraduate Institute of Science, University of Peradeniya, it is my pleasure to welcome all participants to this significant gathering. Microplastics have become a pressing environmental concern, affecting ecosystems and human health globally.

This symposium brings together experts, researchers, and students who are dedicated to understand and address challenges posed by microplastics. The goal of this gathering is to foster a collaborative environment and a platform where innovative ideas can be shared, and meaningful discussions can be taken place. The diverse range of topics covered in this symposium from the sources and impacts of microplastics to their detection, quantification, and mitigation reflects the multifaceted nature of the issue. The research presented here will not only advance our scientific knowledge but also contribute to the development of effective strategies to tackle this crisis.

I extend my heartfelt gratitude to the Vice Chancellor of the University of Peradeniya, Director and staff of the Postgraduate Institute of Science, the review panel, the organizing committee, the speakers, and the participants for their commitment and contributions. Your efforts are crucial in driving forward the research and solutions needed to protect our environment and ensure a sustainable future. I am confident that the insights gained from this symposium will inspire further research and actions that will lead to significant advancements in our battle against microplastic pollution.

Thank you, and I wish you all a productive and enlightening experience at the symposium!

Prof. Nadeeshani Nanayakkara

Chairperson | SYMP 2024

List of Abstracts

SYMP-01

DOES THE SALT WASHING PROCESS EFFECT MICROPLASTIC CONCENTRATION? A STUDY ON COMMERCIAL SALTS AVAILABLE IN SRI LANKA

O.R.K. Kavindi, P.D. Jayathilaka, R.M.W. Kumara, M. Wijeweera, P.A. Aknes and M.D.M.D.W.M.M.K. Yatawara*

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Microplastics (MPs) in food items have become a growing concern due to their potential health and environmental impacts. The present study investigated the presence of MPs in commercial salts available in Sri Lanka. Five commercial brands (A, B, C, D, E) of powdered and crystalline salt were selected based on a questionnaire-based market survey. The selected brands were from Puttalam, Hambantota and Mannar. Three manufacturing batches were selected from each brand for testing. Exactly 200 g of powdered salt was transferred to a 500 mL volumetric flask and dissolved in distilled water, after which 30% H_2O_2 was added. Salt crystals were carefully ground using a mortar and pestle prior to dissolving. The samples were covered, incubated for 24 hours, filtered using a 0.45 µm filter, and dried in an oven at 35°C for 5 hours. MPs were identified by their shapes and colours under a stereo microscope and the heated metal needle test was performed for confirmation, if necessary. One-way ANOVA, followed by Tukey's pairwise comparisons and Student's t-test, was conducted using MINITAB 17 software to identify significant differences in the abundance of microplastics (MPs) among different brands. Microplastics were detected in all salt brands, ranging from 7 to 59 particles/kg. Salt crystals contained more MPs (40 ± 3.7/kg) than powdered salts (22.7 ± 3.6/kg) ($p > 0.5$). Brand D contained the lowest MPs while A had the highest. Although brands B, D, and E were manufactured in Puttalam, brand D, which indicated a triple-washing process, contained the lowest MPs. The MPs consisted of micro-fragments (52%) and micro-fibers (48%). Four distinct forms, *viz*. elongated fibers (48%), spherical (5%), regular (7%), and irregular fragments (40%), of different colors were observed. Black was the most prevalent color (38%) followed by brown (25%) and transparent (13%). The study concludes that the commercial salts selected for the study have been contaminated with MPs. Since the triple-washed brand exhibited the lowest MP content, this process may effectively reduce MPs in salts.

Keywords: Commercial salts, Microplastics, Sri Lanka, Triple-washed

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SYMP-02

EVALUATION OF PLASTIC AND MICROPLASTIC CONTAMINATION IN SELECTED SITES ALONG THE GALLE COAST, SRI LANKA

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The impact of plastics on ecology, economy, human health, and food security has become a global concern. Despite the widespread concern, relatively few studies have looked at the levels of plastic pollution in Sri Lanka. The present study was carried out to assess the amount of plastic and microplastics (MPs) in different areas along the Galle coast. Six sites, representing varying degrees of human influence (near a hospital, fishery harbor, hotels, recreation site, lagoon and a relatively unpopulated beach) were selected for sampling from December 2021 to March 2022. At each site, 5 m × 20 m transects were established to sample plastics and three 30 cm × 30 cm quadrats were established within each quadrat to sample MPs. At each site, a plankton net was utilized to filter seawater for the analysis of MPs in water. The plastics and MPs were classified according to their size, abundance, and type. MPs were categorized as 1 - 2 mm, 0.5 - 1 mm and below 0.5 mm, while those above 2 mm were considered as plastics. Microscopy and FTIR spectroscopic analyses were conducted to detect and identify MPs. Pellets and fragments were the most abundant plastic types while filaments were the most prominent MPs. At Dewata, the fishery harbor site recorded the highest total plastic (62.04 g) and MPs (2.22 g) in soil while Koggala (lagoon site) had the highest amount of plastic (12.48 g) in water. Fishery activities were identified as a major source of MPs and plastic accumulation in Dewata while industrial effluents and ocean-based wind, current, tides and wave action contribute to the accumulation of plastics at Koggala lagoon. This investigation may serve as a foundation for further studies on the abundance and ecological impact of these pollutants, according to seasonal and annual variations in coastal regions of the island.

Keywords: Coastal environment, Microplastics, Plastics, Pollution

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SYMP-04

IMPACT OF MICROPLASTICS ON CARBON SEQUESTRATION CAPACITY OF URBAN WETLANDS IN SRI LANKA: A LITERATURE REVIEW

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This literature review explores the urgent need to investigate the effects of microplastics on the carbon sequestration capacities of urban wetlands in Sri Lanka. Wetlands, recognized for their ecosystem services and significant carbon sequestration, are fundamental in mitigating climate change. However, they are increasingly affected by high levels of plastic pollution, with microplastics continuously released from both point and nonpoint sources. This literature review, examining 40 sources with 15 specifically focused on microplastics, highlights the significant impact of microplastics on various aspects of wetland ecosystems. Microplastics in wetland soil interact with soil microaggregates, organic matter, microbes, and soil particles. Studies show that a 1% concentration of microplastics in wetland soil can affect the ecosystem. Microplastics inhibit soil enzyme activity (urease, sucrase, and catalase) and nutrient turnover, and alter bacterial and algal community compositions, reducing carbon storage efficiency in the soil. This interference also alters the methane cycle of the ecosystem. Additionally, microplastics inhibit plant growth and seed germination, reducing carbon capture through photosynthesis. Studies have shown that microplastics like nylon microfibers and polypropylene pellets can change sediment oxygen consumption, which is strongly linked to sediment organic matter consumption. These negative effects may significantly impact the carbon sequestration capacity of wetland ecosystems. A degraded wetland affects carbon in two ways: it reduces carbon sequestration capacity and releases long-stored carbon as greenhouse gases, converting a carbon sink to a source, and increasing the global warming potential. In Sri Lanka, the total CH_4 emissions from man-made/managed flooded lands are estimated at 4.82 Gg CH_4/yr. Therefore, immediate and effective actions to restore wetlands and mitigate plastic pollution are imperative. The review highlights a noticeable gap in research on the impacts of microplastics on wetland ecosystems, emphasizing the urgent need for comprehensive studies and effective solutions to preserve these ecosystems.

Keywords: Carbon sequestration, Microplastic, Plastic Pollution, Wetlands

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SYMP-06

A COMPARATIVE STUDY OF MICROPLASTIC INGESTION BY *Amblygaster sirm* (SPOTTED SARDINELLA) AT FISH LANDING SITES IN JAFFNA AND NEGOMBO, SRI LANKA

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Plastic pollution in marine environments poses a significant threat to ecosystems and human health worldwide. The tragic X-Press Pearl disaster in Negombo, Sri Lanka, made this issue even more severe, creating concerns about the long-term effects on marine life. This study aimed at investigating microplastic ingestion by *Amblygaster sirm* in two selected fish landing sites in Negombo and Jaffna, Sri Lanka. The study was conducted from August to December 2023. Out of 110 fish samples tested from both sites, microplastics were found in 80 samples. Lengths of microplastics were measured using a micrometre slide and stereomicroscope. The melting points of microplastics were measured using a glass capillary melting point tube. Microplastics were observed under a stereomicroscope and categorized into several types: dark brown and black fragments, dark blue, black, green, and red fibres, pale yellow and brown foam, and Pale-yellow pellets. Eighty-six percent of microplastics collected from fish gills and guts were smaller than 2 mm, while the remaining particles ranged from 2 and 5 mm. The average microplastic particles per fish in gills and gut contents (4.1 ± 17.42 and 2.35 ± 9.98, respectively) were higher in Negombo compared to Jaffna (0.75 ± 3.19 and 0.65 ± 2.76, respectively). The mean total microplastic content in gut samples was lower compared to gill samples in fish sampled from both locations. The higher concentration of microplastics in the gills compared to the guts may be attributed to the planktivorous feeding habit of *A. sirm*. Based on melting points, the identified microplastics were classified into Polystyrene, Polyvinyl Chloride (PVC), Polyester, and Nylon. The study suggests a potential link between the X-Press Pearl disaster and the comparatively higher level of microplastic concentrations in Negombo's fish. It emphasizes the need for stricter regulations, enhanced awareness campaigns, ongoing cleaning programmes and further research to effectively combat marine plastic pollution.

Keywords: Fish, Jaffna-Sri Lanka, Negombo, Plastic, Pollution, X-press Pearl

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SYMP-07

A SURVEY ON PUBLIC PERCEPTION TOWARDS PLASTIC POLLUTION TWO YEARS AFTER THE X-PRESS PEARL SHIP DISASTER IN NEGOMBO COAST, SRI LANKA

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The escalation of plastic pollution along the coast of Sri Lanka has surged over the past decade. This issue has been worsened since the X-Press Pearl maritime ship disaster occurred in May 2021. The present study aimed to evaluate public perception of plastic pollution, specifically focusing on the Negombo area, including Negombo beach, fish landing site, fish markets, Morawala beach, and Pitipana, two years after the X-Press Pearl disaster. The study used a questionnaire-based survey employing a Likert scale. A total of 258 individuals voluntarily participated in the survey. All participants agreed that the Negombo coastal area had undergone environmental changes since the X-Press Pearl disaster, reflecting a high level of ecological awareness among the community. All the respondents agreed that plastic pollution has adversely affected the local economy, particularly the fishing industry. While some respondents expressed satisfaction (13.9%) with the government-mediated initiatives to manage plastic pollution, a significant fraction remained neutral (52.7%) or dissatisfied (27.5%). A perfect positive correlation ($r = 1.0$) was observed between families with diverse occupational backgrounds and their awareness of plastic pollution. Families related to the fishing industry demonstrated higher levels of awareness of plastic pollution. There was a moderately positive correlation ($r = 0.6$) between the level of plastic pollution and support for more stringent laws. Higher awareness of plastic pollution is associated with a greater likelihood of supporting stringent laws to address the issue and recognizing the importance of community involvement in solving environmental problems. The analysis also underscores the community's consensus (71.3%) on the need for stricter regulations and policies to prevent future incidents of plastic pollution. There is widespread recognition (87.6%) of the crucial role that universities and local communities can play in mitigating plastic pollution, underscoring the importance of collaborative, multi-sectoral approaches to tackling this global challenge.

Keywords: Plastic, Pollution, Marine ecosystems, X-press Pearl, Survey, Public awareness

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SYMP-08

COMPARATIVE ANALYSIS OF PLASTIC ACCUMULATION IN URBAN AND RURAL COASTAL AREAS IN THE NORTHWESTERN COAST OF SRI LANKA

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Plastic pollution in the marine environments around Sri Lanka has not been adequately addressed. In this study, the accumulation of macro, meso and microplastics (MPs) of an urban (Chilaw) and a rural beach (Thoduwawa) was evaluated monthly from June to November 2023. The study also analyzed the variation in plastic density between estuary and non-estuary areas along the beaches. Data were collected along five 100 m transects from a one-kilometer stretch of beach at each location. Per transect, five 1 m^2 quadrats were used to collect macro and mesoplastics, while three 0.5 m^2 quadrats were used to sample for MPs (large MPs 5 mm - 1.1 mm, small MPs 1 mm - 500 µm) from beach sand. The Clean-Coast Index (CCI) was used to calculate macro and mesoplastic density. CCI in urban sites (41.4 items/m^2) was higher compared to rural sites (27.0 items/m^2) indicating that the rural beaches were cleaner than urban beaches. The most abundant macroplastic type was plastic bottles (PET) in both sites. The mean abundance of MPs in urban beaches was lower than in rural beaches. The average highest number of large MPs and small MPs per transect at urban sites were 11.67 ± 2.51 and 15.67 ± 1.02, respectively. In contrast, rural sites had the highest numbers of large MPs and small MPs per transect at 18.33 ± 3.10 and 12.00 ± 1.00, respectively. Since cleanup operations are frequent in urban beaches, MP pollution in urban sites was lower than in rural locations. Sites closer to the estuary had a higher concentration of MPs compared to sites further away from the estuary. The most common shape and polymer type of MPs were pellets and polyethylene. This study indicates that the plastic pollution in coastal environments requires further monitoring and cleanup activities to overcome current and future impacts.

Keywords: Marine pollution, Microplastics, Pellets, Rural beach, Urban beach

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SYMP-09

MICROPLASTIC ANALYSIS IN SURFACE WATER AND SEDIMENTS OF KELANI RIVER MEANDERING ZONE

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Plastic pollution has emerged as a global crisis, with millions of tons of plastic waste entering the environment each year. This pervasive pollution not only harms wildlife and ecosystems but also poses significant health risks to humans via contamination of food and water supplies. River Kelani, Sri Lanka, a critical water source for the western province, has received the least attention in terms of Microplastic (MP) contamination. Hence, this study was conducted to assess the abundance of MPs in River Kelani during the wet season in August 2023, via a rapid sampling process, utilizing bulk sampling method. Water (100 L) and sediments (1 kg) were collected, with three replicates from seven key locations. Organic matter was removed using Fenton's reagent, Digested water samples underwent sieving using a stainless-steel sieve set, and MPs were categorized based on their size. Density separation technique using NaCl was employed to isolate microplastics from sediment samples. Polymer types were identified using FT-IR spectrometry. Results were analysed using one-way ANOVA to identify whether the data were statistically significant. The analysis revealed a significant presence of plastic films (68%) in both sediment and water samples followed by fragments (27%), with white (32%) being the predominant colour. The most detected MP size category was 2 – 1 mm. MP were more abundant in sediments (10 ± 7 to 53.33 ± 10.41 items/kg) compared to surface water samples (0.01 ± 0.01 to 0.86 ± 0.24 items/L). High-Density Polyethylene (26.5%), Polypropylene (24.5%), and Polyethylene (21.7%) were the most commonly detected polymers in both sample types. The majority of the MPs appeared to be degraded fragments or films of macro plastics. The presence of MP in the river water poses a possible risk of ingestion through drinking water consumption. Future research in the Kelani River could focus on longitudinal studies to assess temporal trends in MP pollution or investigate the sources and pathways of MPs.

Keywords: FT-IR spectrometry, Kelani River, Microplastic, Sediment, Surface Water

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SYMP-10

MICROPLASTIC DISTRIBUTION IN AGRICULTURAL LANDS: A CASE STUDY FROM SELECTED AGRICULTURAL FIELDS IN THE GAMPAHA DISTRICT OF SRI LANKA

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Agricultural lands around the world are threatened by microplastic pollution. However, less is known about the occurrence and distribution of microplastics in different types of agricultural lands in Sri Lanka. This study aimed to quantify and characterize the microplastics present in selected agricultural lands in the Gampaha District in Sri Lanka and to speculate on their potential sources. Three distinct types of agricultural lands: paddy fields, vegetable plots, and coconut cultivations, were selected for the study from the Gampaha District. Surface soil samples were collected from the agricultural lands (n = 15 per each type of agricultural land) and analysed in the laboratory using several steps: density separation using $ZnCl_2$, organic matter digestion by H_2O_2, and microplastics observation and quantification using a stereomicroscope. Microplastics were classified based on their shape (fibres, fragments, foams, spheres, and films) and colour. Representative pieces of microplastics from the samples were analysed by Fourier Transform Infrared Spectroscopy (FTIR) to identify their constituent polymer types. The results revealed that the paddy fields had a higher number of microplastics (427 – 613 pieces/kg soil) compared to the vegetable plots (253 – 434 pieces/kg soil) and coconut cultivations (54 – 153 pieces/kg soil). Fibres were the dominant shape of microplastics in all types of agricultural lands. Furthermore, the microplastics of blue and black colour were the most common colours in all types of agricultural lands. FTIR results confirmed the presence of polyester, polyethylene terephthalate, polypropylene, and polystyrene microplastics. Furthermore, from face-to-face interviews conducted with the farmers who owned the agricultural lands and field observations, the suspected sources of microplastics in these agricultural lands were irrigation water, mulching materials, organic fertilizers, and inputs from air drift from nearby roads and industries. This study offers first-hand information about the microplastic distribution in agricultural lands in the Gampaha district of Sri Lanka.

Financial assistance for case study, from the Department of Zoology and Environmental Management, University of Kelaniya.is acknowledged.

Keywords: Agricultural soils, Agroecosystems, Gampaha district, Microplastic pollution

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SYMP-11

MUNICIPAL SOLID WASTE COMPOST CONTAMINATED WITH PLASTICS AND THEIR TRACE METAL TOXICITY

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Contamination of compost produced from Municipal Solid Waste (MSW) with plastics is unavoidable due to the low effort given to separate non-degradable matter from MSW before composting. The presence of plastics can influence trace metal levels in MSW-based compost in either positive or negative ways. Due to the adsorption potentials of plastics, trace metals already present in compost may be adsorbed by plastics, or innate metals present in plastics can be released into compost. Therefore, this study was conducted to quantify the total toxic metal levels in MSW compost and plastic particles extracted from MSW compost collected from 54 local authorities and dumping sites in Sri Lanka. Plastics were extracted using density separation and digested using wet peroxidation. Compost and extracted plastics were acid-digested to quantify total Cd, Cu, Co, Cr, Pb, and Zn concentrations using Inductive Coupled Plasma Optical Emission Spectroscopy. Plastics were highly abundant in compost samples obtained from Kurunegala, Kalutara, Mahiyanganaya, Ratnapura, Karadiayana, and Muthurajawela composting plants (200, 180, 180, 170, 170, and 160 particles/kg respectively). The average Cd, Cu, Co, Cr, Pb, and Zn levels in compost were 0.727, 60.78, 3.670, 25.44, 18.95, and 130.7 mg/kg, respectively, which are well below the recommended levels. The contamination factor data show that there is considerable enhancement of Cd and Cu, however, Cr, Cu, Co, and Pb are at low contamination levels. Mean geo accumulation index values were 1.39, 1.07, -1.06, -0.84, -0.32, and 0.08 for Cd, Cu, Co, Cr, Pb, and Zn. Therefore, the contamination level of compost samples with Cd and Cu ranges from uncontaminated to contaminated levels, whereas Co, Cr, Pb, and Zn are at uncontaminated levels. Regardless of no direct metal-plastic correlation, plastics in compost could harm plants, animals, and humans due to ingestion. Hence, reducing plastics and metal contamination in compost is crucial.

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Keywords: Composting, Microplastic, Municipal Solid Waste, Plastic, Trace Metals

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SYMP-12

UNVEILING THE HIDDEN THREAT: MICROPLASTIC OCCURRENCE IN DIKKOWITA FISHERIES HARBOR

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Microplastics, plastic fragments less than five millimeters in size, are emerging as a major global environmental concern. Their widespread presence in aquatic ecosystems, from the surface to deep sediments, disrupts marine life through ingestion and bioaccumulation. The full extent of microplastic contamination on terrestrial ecosystems and human health is still being explored, but a plethora of studies suggest potential risks. The present study evaluates microplastic contamination in surface water, sediment, and beach sand in the Dikkowita Fisheries Harbor and adjacent coast. Sample collection was done in July 2023. Water sampling was carried out using a plankton net of 50 µm mesh size. Sediment samples were collected using a grab sampler and sand samples using a 50 cm × 50 cm quadrat. Samples were subjected to wet sieving, wet peroxide oxidation, density separation, and vacuum filtration. The extracted microplastics were visually observed and quantified for their type, color, and size via a stereomicroscope. The polymer-type characterization was carried out using micro Fourier Transform Infrared Spectroscopy (micro-FTIR). According to the results, fragment-type microplastics predominated in surface water (50%), sediment (47%), and beach sand (58%), followed by fibers/filaments. The most prevalent color was blue in surface water (55%,), sand (39%), and sediment samples (42%), followed by green in surface water (18%), sand (16%), sediment (32%), and red in surface water (5%), sand (11%), and sediment (8%) samples, respectively. The majority of fibers and filament particles appear to originate from fishing activities, such as the use of nylon fishing nets. However, further experiments and long-term monitoring are needed to determine possible sources.

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Keywords: Aquatic ecosystems, Beach sand, Microplastic, Sediments, Surface water

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SYMP-13

WEATHERING EFFECT AND DIFFERENT ELEMENTAL INTERACTIONS OF MICROPLASTIC NURDLES DISCHARGED FROM X-PRESS PEARL SHIP ACCIDENT

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The present study examined the weathering and size reduction of microplastic nurdles released during the X-press Pearl ship accident over time. Beach sand samples were collected from Sarakkuwa Beach, Sri Lanka, at four intervals following the accident; 1, 4, 16, and 28 months. Nurdles were extracted via density separation (NaCl) followed by wet peroxide digestion and analyzed using digital microscopic imaging, Fourier transform infrared (FTIR) spectroscopy, and X-ray photoelectron spectroscopy (XPS). The volume reduction of weathered nurdles was measured using densitometric titration. Microscopic images revealed increased surface roughness, cracks, and voids. Additionally, FTIR spectra of the weathered nurdles showed new bands corresponding to C=O, S=O stretching, and CO-O-CO bending vibrations, which were not present in the pristine nurdles. The S=O in yellow-colored nurdles was attributed to surface sulfur adsorption, originating from elemental sulfur present in the vessel. Weathered nurdles collected after 16 months showed higher peak intensities in XPS spectra for Li1s, N1s, S2p, and Mo3d compared to pristine nurdles, indicating the prolonged chemical exposure, including those from Li batteries, urea, elemental sulfur, and molybdic oxide, which were onboard the vessel. The percent mean volume reductions of weathered nurdles collected 1, 4, 16, and 28 months after the accident were 44.6, 53.7, 57.5, and 61.2%, respectively suggesting continuing size reduction. Rapid weathering onset is attributed to the immediate exposure to hazardous chemicals and fire, followed by a gradual degradation over time, influenced by factors like UV irradiation, atmospheric oxygen exposure, and wave action. Additionally, the rapid weathering may be due to the presence of degraded nurdles, with larger fragments potentially accumulating in sea sediments. This study elucidates the enduring presence of nurdles from the X-press Pearl ship, suggesting long-term implications. Further research should focus on monitoring the size reduction of nurdles and their presence in seagrass, seaweeds, and fish.

Keywords: Elemental interactions, Marine microplastics, Nanoplastics, Nurdle spillages, Surface adsorption, X-press pearl

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SYMP-14

DETECTION AND EFFECTS OF MICROPLASTICS IN DRINKING WATER: A REVIEW

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Microplastics (MPs) are small pieces of plastic less than 5 mm in length, they are particles of predominantly synthetic polymeric composition in the micro-scale. This review examines the presence of microplastics in drinking water, detection methodologies, and their impacts on human health, based on 21 studies from around the world. Microplastics have been reported in rivers, lakes, bottled water, tap water, groundwater wastewater, and treated water. According to the selected studies, the concentration range of the MPs is between 1 - 7000 particles per liter. A higher number of MPs has been reported in all types of drinking water and these microplastic types vary from microfiber to fragments between the size 1 to 5000 µm. The highest number of MPs have been reported in bottled water, tap water, and groundwater, with averages of 9.50 - 50.60 particles/500 mL bottle and 0.01 - 9.24 particles/L and 0.10 - 6832 MPs/L respectively. These MPs vary in type from microfibers to fragments, sized between 1 and 5000 µm. Studies showed that the presence of MPs in drinking water can cause severe health implications including allergic reactions, cancers, damage to human cells, asthma, DNA damage, oxidative stress, and others since they have toxicity associated with polymeric composition, additives, and other compounds. Boiling, filtering and advanced water treatment methods can be introduced to minimize the number of MP particles in drinking water to minimize health impacts. Future research is essential to fully understand and address the long-term health implications of microplastics in drinking water.

Keywords: Bottled water, Drinking water, Groundwater, Health effects, Microplastic, Tap water

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SYMP-15

SPATIAL DISTRIBUTION AND DENSITY OF PLASTIC NURDLES ON DEHIWALA-MOUNT LAVINIA COAST, SRI LANKA

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The X-Press Pearl accident was the worst maritime environmental disaster in Sri Lanka. Nurdle spill and spread were evident from Panama on the east coast to Thaleimannar on the Northwest coast. In order to understand the chronic nurdle pollution and its nature, the spatial distribution of virgin plastic nurdles from 15 locations spread over the Mount Lavinia coast, Colombo West (6.83724° N, 79.86296° E) was surveyed after three years of the initial incident on 20th May 2021. Three sites were surveyed for plastic nurdles on five consecutive days with replicates using 20 m transect lines perpendicular to the coastline, covering 1.2 km of the coastline. On each transect, 5 points at 4 m intervals were selected to collect samples named L1 to L5, from the high-water line to the nearest permanent vegetation line, respectively. Virgin pellets were collected and counted to calculate the Clean Coast Index (CCI). The average density was 12.3 ± 1 (plastic nurdles) per 1 m^2. Based on an average density of 12.3 plastic nurdles per square meter, with each nurdle averaging a weight of 20 mg, approximately 246 mg of plastic were released into the environment per square meter. Moreover, according to the mean CCI of 16.625, L4 site showed the highest pollution of nurdles in the middle part of the coast. Plastic nurdles, being ubiquitous microplastic fragments, are the 2nd largest source of primary microplastic source in the ocean which are integrated into food chains via ingestion by organisms at lower trophic levels, thereby bioaccumulating and biomagnifying until reaching human consumption or environmental exposure. These findings underscore the urgent need for beach cleanliness and awareness to prevent future spills, given the relentless pressure of coastal pollution along Sri Lanka's western coast.

Keywords: Clean Coast Index, Maritime accidents, Plastic nurdles, Plastic pollution

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SYMP-16

SUSTAINABLE SYNTHESIS OF RICE STRAW-DERIVED CELLULOSE NANOCRYSTALS FOR BREAKING THE BARRIERS IN BIODEGRADABLE PLASTICS

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Biodegradable plastics break down naturally into harmless substances, reducing environmental pollution. However, biodegradable plastics often lack mechanical strength and thermal stability compared to non-renewable plastics. Cellulose nanocrystals (CNC), the crystalline form of cellulose, provide a promising remedy to these limitations in biodegradable plastic. Cellulose nanocrystals have gained prominence due to remarkable attributes such as high specific surface area, biodegradability, renewability, and non-toxicity. When incorporated into biodegradable plastics, CNCs enhance their mechanical properties, improve barrier performance, and potentially reduce the overall environmental impact, offering a more sustainable alternative to conventional plastics. Although CNCs offer many advantages, there are still challenges associated with their production. These include the need for high temperatures, high production costs, and equipment corrosion in large-scale production. To address these issues, this study utilized deep eutectic solvent (DES)-based reaction media for the two steps in CNC synthesis. DES is considered eco-friendly due to its biodegradability, renewability, low toxicity, non-volatility, energy efficiency, and versatility in various industrial applications. Rice straw (RS) was used as the raw material and pretreated with choline chloride–lactic acid using the solvothermal method at a 1:25 solid-liquid ratio at 190 °C for 1 hour. The post-delignification of pretreated rice straw (PRS) resulted in enhanced cellulose purity (73.19%). In the second step, using the same DES media, three different CNCs were synthesized: one directly from RS (CNC-RS), another from the pretreated RS (CNC-PRS), and a third one from microcrystalline cellulose (CNC-MCC). The synthesized CNCs were characterized using SEM, TEM, FTIR, XRD, TGA, and DLS. All three CNCs displayed nanoscale dimensions, with CNC-MCC at approximately 283.55 nm, CNC-PRS at 370.03 nm, and CNC-RS at 690.13 nm. FTIR and XRD analyses confirmed the presence of cellulose Iβ in the CNCs, which also exhibited superior thermal stability, withstanding temperatures above 260 °C. This performance surpasses that of CNCs produced through sulfuric acid hydrolysis. This study shows that sustainable CNC production from rice straw using DES-based methods and incorporation of CNC can effectively overcome the challenges of biodegradable plastics.

Keywords: Cellulose nanocrystalline, Deep eutectic solvents, Pretreatment, Rice straw, Solvothermal method

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SYMP-17

OCCURRENCE OF MICROPLASTICS IN FISH FROM THE GIN RIVER ESTUARY AND ASSOCIATED WATERS, SRI LANKA

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Estuaries are recognized as significant microplastic (MP) accumulation zones within coastal ecosystems, with fish being particularly susceptible to contamination. Despite this serious concern, there is a scarcity of studies estimating MP contamination in estuarine environment and biota, particularly in Sri Lanka. This study aimed to assess the occurrence of MPs in fish of the Gin River estuarine environment and identify their characteristics. A total of 50 fish comprising 8 species, were collected from the Gin River estuary and associated waters*: Systomus sarana* (n = 10; Omnivorous), *Channa striata* (n = 4; Carnivorous), *Clarias brachysoma* (n = 3; Carnivorous), *Anabas testudineus* (n = 5; Omnivorous), *Puntius dorsalis* (n = 5; Herbivorous), *Garra ceylonensis* (n = 2; Herbivorous), *Mystus gulio* (n = 9; Omnivorous) and *Sillago vincenti* (n = 12; Carnivorous). The gills and gastrointestinal tract (GIT) of fish were extracted and digested using 10% potassium hydroxide (KOH) solution, followed by 5 days incubation at 60 °C. The digested samples were vacuum filtered through 1.2 µm Whatman GF/C microfiber filter papers, and MPs were observed using a stereomicroscope with fluorescence tagging of polymers using Nile Red. The average abundance of MPs was found to be 11.24 ± 7.07 particles/individual with the gills and GIT containing 4.55 ± 3.42 particles/g and 6.78 ± 4.83 particles/g, respectively. MPs were predominantly blue in color (35%), followed by transparent (23%), black (14%), red (11%), yellow (7%), white (6%), green (2%), and purple (1%). Fibers were the most abundant shape of MPs, comprising 84% of the total, followed by foam (7%), film (5%), and fragments (4%). The majority (47%) of MPs were between 1 mm to 5 mm in size followed by 26% in 0.5 mm to 1 mm and 27% in 0.1 mm to 0.5 mm size category. Although MP contamination showed no significant difference ($p > 0.05$) among feeding behaviours of fish species, there was a significant difference ($p < 0.05$) in contamination levels among fish species (One-way ANOVA; $p = 0.001$). Highest MPs contamination recorded in *M. gulio* with 16.33 ± 5.14 particles/individual and lowest in *S. sarana* with 3.90 ± 1.66 particles/individual. These results highlight the widespread presence of MPs in fish species, indicating significant MP pollution within the Gin River estuary and associated waters.

Keywords: Estuary, Gastrointestinal tract, Gills, Microplastics, Sri Lanka

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SYMP-18

MICROPLASTIC CONTAMINATION IN DIFFERENT SOURCES OF WATER FEEDING INTO ACCELERATED THE NATURAL REGENERATION OF MANGROVES SITE IN THE ANAWILUNDAWA RAMSAR SANCTUARY, SRI LANKA

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An annual assessment of plastic debris has been conducted since 2022 at the Accelerated Natural Regeneration of Mangroves (ANRM) site in Anawilundawa as a part of a long-term study aimed at restoring abandoned shrimp farms back to their natural vegetation. As microplastics can impact flora and fauna, it is important to quantify and identify them in water sources that feed into restoration areas. The present study assessed locations along the Southern boundary (Muthupanthiya) and Northern boundary (Udappuwa) of the ANRM site during October to December 2023. At each site, sediment and water samples were collected from four areas representing restored mangrove, Dutch Canal, shrimp farm outlet and paddy field outlet. For water samples, 20 L was sieved through a 200 µm filter. Organic matter was digested using 30% H_2O_2 and filtered through a 0.45 µm filter. Sediments (500 ml) were subjected to density separation using 1.5 g cm^{-3} NaCl, following the same procedure. Extracted microplastics were categorized by shape and color under a stereomicroscope and polymer types were confirmed by ATR-FTIR. The highest microplastic concentrations in water were recorded in the Dutch canal (2.48 ± 0.43 pieces/L) while the lowest was in the mangrove restoration site (0.17 ± 0.06 pieces/L). Conversely, the highest microplastic abundance in sediment was recorded in mangrove restoration sites (61.33 ± 4.16 pieces/L) and the lowest in paddy fields (11.33 ± 2.03 pieces/L). Filaments and fragments were the dominant microplastic shapes in both water and sediments and blue and white emerged as the dominant color in both water and sediments which was the same result as in 2022. Detected microplastics belonged to Poly[ethylene: propylene] groups. The present study further confirms that microplastic is an emerging issue in the coastal systems requiring urgent attention and strategic management.

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Keywords: Density separation, Mangrove, Microplastic, Restoration of mangroves

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SYMP-19

INTERACTIONS BETWEEN MICROPLASTICS AND DIFFERENT SOIL TYPES

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The undeniable presence of microplastics (MPs) in soils causes significant environmental issues by altering the soil's physicochemical properties. The most common and widely applicable method of MP extraction from soil is density separation using NaCl and flotation technique following the removal of organic matter by adding 30% H_2O_2 and heating up to 50 °C. Microplastics can interact with various soil components a variety of ways. Hence, a common extraction method is not applicable for optimum recovery of MPs from different types of soils. The present study evaluated the efficiency of density separation method for extracting MPs from various soil types. Known amounts (n = 25) of Polyethylene Terephthalate (PET) MP samples were aged in four different soil types; grumosols (GS), red-yellow latasolic soils (RYLS), kaolinite soils (KS) and sandy soils (SS). Separate experimental setups, with replicates for each exposure time (7, 14, 21, 28, 35, 42, 49, 56 days), were conducted over a period of 2 months. These setups were maintained under ambient light conditions and consistent moisture throughout the period. At each time interval, the number of MPs extracted using the density separation method was recorded. The MP recovery percentages in SS were 100% in all time intervals, while in RYLS, it gradually decreased from 60% to 0% during the 2 months' period. Fourier Transform Infrared Spectroscopic results of aged MPs in RYLS showed peaks at 536 cm^{-1} and 637 cm^{-1} that corresponded to stretching vibrations of Fe-O-OH, and Fe-O, respectively, indicating interactions between soil Fe and MPs. Grumusols and kaolinite soils showed <40% MPs recovery from 0 - 21 days and 0% recovery after that. A decrease in MP recovery over time was observed in all soil types except for SS, which showed maximum recovery throughout the period, suggesting minimal interaction between MPs and soils. The recovery of MPs in clay-rich soils (GS and KS) was less than 40%, and in iron-rich soils (RYLS) it was less than 60%, even after 7 days of exposure. The data confirmed that the density separation and floatation method was not effective for Fe and clay-rich soil types. Hence, a comprehensive investigation on the interactions between MPs and clay and Fe is needed to develop an efficient MPs extraction method, especially for soils rich in clay and Fe.

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Keywords: Density separation, Extraction, Microplastics, Soil components

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SYMP-20

QUANTIFICATION OF LOW-DENSITY MICROPLASTICS IN FARMLAND SOILS: A CASE STUDY FROM SRI LANKA

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Plastic particles in soils pose a persistent and widespread threat to organisms and environmental health. Compared to aquatic and marine habitats, microplastics (MPs) pollution in soils has received relatively less attention. However, soil serves as a major sink for MPs, making it crucial to understand the extent of contamination to enact regulations aimed at mitigating potential impacts. Agricultural soils are polluted by various farming practices, such as mulching and the addition of compost. This study was conducted in vegetable-growing fields in Kurunegala and Dambulla, two major districts in Sri Lanka where vegetable cultivation prevails. Twenty surface soil samples (0 - 15 cm) were randomly collected from farmer-managed vegetable fields in each district to assess soil MP levels. MPs (density lower than 1.00 g/mL) were isolated through density separation following an optimized chemical digestion of 50 g soil (< than 2 mm in size) in 100 ml of acidified water containing 5 ml of 30% H_2O_2 at 60 - 70 °C. A stereomicroscope was used to quantify MPs. Data was statistically analyzed in Minitab (Version 18.0). Results revealed a significantly higher MP abundance in Kurunegala vegetable fields (88 ± 92 particles/kg) compared to Dambulla (27 ± 19 particles/kg). In Dambulla, a higher proportion of 'fibers' (~83%) was observed in comparison to 'fragments' (~17%). Conversely, Kurunegala soils exhibited nearly equal levels of 'fragments' (~57%) and 'fibers' (~43%). Across both sites, MPs were predominantly less than 2 mm in size (~99% and ~93%, respectively). Due to the minute size of MPs in Dambulla, FTIR analysis could not be conducted. In Kurunegala, the majority of MPs were white fragments (~53%) that were characterized as Polypropylene (PP). The observed differences in the quantity and type of MPs between sites may be attributed to varying agricultural practices and implements used by farmers in each area. These findings underscore the importance of implementing tailored strategies to mitigate the potential impacts of MPs in agricultural soils and enforcing strict regulatory measures to minimize plastic usage.

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Keywords: Farmland soil, Microplastic pollution, Low-density microplastics, Polypropylene, Sri Lanka

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SYMP-21

DETECTION AND MONITORING OF MICROPLASTICS USING DEEP LEARNING MODELS

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Microplastics (MPs) in aquatic ecosystems create a significant threat to environmental and human health. Thus, the detection and monitoring of microplastics is essential in managing MPs pollution worldwide. However, existing traditional methods for MPs detection are time consuming, often depend on human expertise, and difficult in large-scale monitoring. This review was conducted (1) to identify an accurate, time saving, user-friendly deep learning method for detection and monitoring MPs and (2) to assess the improvement of the efficiency of MPs detection and monitoring *via* new deep learning models compared to traditional methods. The literature review was conducted using the Google Scholar search engine. This study examined relevant peer reviewed research articles published from 2020 - 2024. A total of 35 relevant articles were selected and analyzed. The majority of studies have demonstrated the use of different deep learning models like Res-Net, U-Net, VGG16 and YOLO for MP detection and monitoring projects. The performances of these models have been assessed using mean average precision (MAP). Furthermore, the results indicate that the performance varies depending on the specific dataset and experimental setups. VGG16 and U-Net have reported accuracies exceeding 98%. The advent of advanced architectures such as YOLO (You Only Look Once) v4, v5, and v8 has demonstrated superior performance in terms of speed and accuracy, ranging from 90% to 100%, compared to earlier versions and other traditional methods. Notably, these trained models require only a few seconds (typically between 2 to 5 seconds) to detect and classify new MP images, making them a viable and rapid solution for addressing the emerging global issue of microplastic detection. Additionally, the user-friendliness of these models was evaluated based on factors such as ease of implementation, availability of pre-trained models, and the requirement for extensive computational resources. These models handled a large amount of data rapidly. Moreover, these new deep learning models not only can be upgraded to real-time MP detection devices in future experiments, but these can be also coupled with remote sensing technologies to track the dispersion and environmental impact assessments caused by MPs.

Keywords: Artificial intelligence, Deep learning methods, Microplastics classification and monitoring, Image analysis

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SYMP-22

INVESTIGATION OF MICROPLASTICS IN URBAN PAVED SURFACES

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Urban areas are confronting growing challenges from pollution, with microplastics becoming a significant concern due to their persistence in the environment and potential impacts on ecosystems and human health. Road dust is a significant source of microplastic pollution on urban paved surfaces, as microplastics can easily become suspended in runoff, leading to contamination of water bodies. This research addresses knowledge gaps regarding the presence and accumulation of microplastics on urban paved surfaces in Kandy, Sri Lanka. This study focuses on three locations in Kandy, examining road surfaces and parking areas to understand the distribution and accumulation of microplastics. Field sampling points were selected based on factors such as traffic intensity, proximity to commercial areas, and road categories. Collected road dust samples were separated into three size fractions, and microplastics were extracted from each fraction using density separation. Advanced laboratory techniques, including Fourier Transform Infrared Spectroscopy (FTIR) for polymer identification and Scanning Electron Microscopy (SEM) for detailed microplastic analysis, were utilized to characterize the properties (type, shape, size) of microplastics. Significant concentrations of microplastics were detected in road dust particles finer than 1 mm, with distribution variations linked to traffic density and proximity to commercial areas. This evidence of microplastics on urban road surfaces and parking lots underscores the need for further investigation into their pathways and a comprehensive assessment of the environmental risks associated with road-deposited microplastics.

Keywords: FTIR, Microplastics, Road dust, Tyre wear

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SYMP-23

MICROPLASTICS DISTRIBUTION IN FLOODPLAINS OF THE MAHAWELI RIVER IN SRI LANKA

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Rivers facilitate the transportation of Microplastics (MPs) within the terrestrial environment. Before reaching their final destinations, such as oceans, lagoons or lakes, MPs are often deposited in river floodplains. Floodplains are heavily utilized for crop cultivation as the sediments are rich in nutrients. Therefore, MPs in floodplains can significantly impact plant physiology and pose health risks to the human population. Although monitoring of MPs in rivers is common, limited attention is given to the distribution of MPs in floodplain sediments. This study reports the distribution of MPs in floodplain sediments of the Mahaweli river in Sri Lanka. Sediment samples were collected from 14 locations along the Mahaweli river from Kandy to Trincomalee during May 2023. Standard MPs extraction method (density separation followed by H_2O_2 digestion) was applied to extract MPs. Multiple extraction steps were carried out to obtain maximum recovery. A stereomicroscope was used to observe the morphological features of MPs and to quantify them. The chemical composition of MPs was analyzed using Raman spectroscopy. Microplastics were classified based on shape, color and polymer type. The highest concentration of MPs was reported in Manampitiya area (250 pieces/kg of dry sediment) while the lowest was reported in Muthur area (40 pieces/kg of dry sediment). Extensive anthropogenic activities including bathing, washing, recreational activities may have increased the MP accumulation in Manampitiya area. Compared to Manampitiya, the Muthur area experiences less anthropogenic influence, resulting in lower MP levels in its sediments. In addition, the composition of floodplain sediments may also have affected the recovery of MPs. Sand-rich sediments in Manampitiya may have fewer interactions with MPs allowing maximum recovery, while the stronger interactions between MPs and clay particles in sediments in the Muthur area may have lowered MP recovery. Among the observed MPs, the predominant shape was fibers followed by fragments. Black was recorded as the most abundant color. Among different types of polymers detected, including amides, amines, aldehydes, ketones esters and aromatic hydrocarbons, polyamide was identified as the dominant type. These MPs may have been released into the environment through activities such as washing clothes or the use of fishing gear.

Financial assistance provided by the Grant No. PGIS/2022/09 is highly acknowledged.

Keywords: Density separation, Floodplains, Microplastics, Sediments

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SYMP-24

REMOVAL OF MICROPLASTICS USING ELECTROCOAGULATION METHOD

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Water pollution due to Microplastics (MPs) presents a significant environmental threat, with wastewater treatment plants identified as a major source. This study explores the potential of utilizing electrocoagulation (EC) technology, a promising method due to its versatility, ease of setup, low footprint, eco-friendly nature, and low chemical need, for efficient MP removal from domestic wastewater. The research focuses on optimizing key EC parameters such as current density and reaction time, to balance treatment performance and cost-effectiveness. The investigation utilizes polyethylene MPs (size range: 150 - 300 μm) added into synthetic domestic wastewater with a controlled MP concentration of 0.1 g L^{-1}. Aluminium electrodes are employed in the EC process, along with sodium lauryl sulphate (0.020 g L^{-1}) as a surfactant to promote uniform MP suspension. Characterization of the synthetic wastewater includes measurements of electrical conductivity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), and pH. Preliminary experiments yielded promising results, demonstrating 82% removal efficiency of MPs under 10 minutes of reaction time and 2.98 mA/cm² current density at a pH of 6.50 and 10 V. Observations suggest a combined removal mechanism involving both electrocoagulation and electro-flotation, the latter facilitated by hydrogen gas generation at the cathode during the EC process. These initial findings highlight the potential of EC technology for effectively removing MPs from domestic wastewater. Further research will delve into the optimization of EC parameters using the Design of Experiments (DoE) methodology. In order to address this new environmental concern, our research offers a unique and novel method by optimizing EC parameters of current density and reaction time, especially for MP removal from domestic wastewater.

Keywords: Electrocoagulation, Microplastics, Removal of microplastics, Wastewater treatment

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SYMP-25

REMOVAL METHODS OF MICROPLASTICS FROM WASTEWATER: A REVIEW

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Microplastics (MPs), defined as plastics less than 5 mm in size, are a common and persistent contaminant found in various environments, including soil, water, air, and biota. They can adsorb other pollutants and have properties such as long residence time, high stability, and the potential to fragment further. While the potential risk of microplastics in drinking water to human and environmental health is suspected, removing them from water sources is urgent. The primary source of microplastics entering surface water is wastewater discharge. Developing wastewater treatment technologies to remove microplastics is crucial. Three main approaches for microplastic removal from wastewater are physical, chemical, and biological methods. Physical methods, like filtration, sedimentation, and membrane processes, have been widely studied for their effectiveness. However, challenges remain, such as cost, energy consumption, and removing smaller microplastics. Chemical methods, including coagulation, flocculation, and advanced oxidation processes, offer promise by promoting aggregation and degradation. Biological methods, utilizing biodegradation by microorganisms and phytoremediation with aquatic plants, present environmentally friendly alternatives. Harnessing these natural processes demonstrates the potential for sustainable and cost-effective mitigation of microplastic pollution in wastewater. Chemical techniques may be more effective than physical techniques for aggregation and maybe even some deterioration, but they come with environmental risks. Physical methods are faster than biological procedures, while biological methods use natural processes and are less harmful to the environment. The most effective solution might lie in combining existing and emerging technologies like an Electrocoagulation-membrane filtration hybrid system. Future research should focus on optimizing treatment processes, assessing environmental impacts, and exploring novel approaches for efficient microplastic removal from wastewater.

Keywords: Microplastics, Microplastic Removal, Wastewater Treatment

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SYMP-26

MICROPLASTICS IN FOOD AND WATER: CONSUMER AWARENESS AND HEALTH RISKS AMONG SRI LANKANS

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Microplastics are an emerging silent menace and their potential hazards are a major concern worldwide. This study aimed to comprehensively assess consumer awareness and health risks related to microplastics among Sri Lankans. A questionnaire was pretested and distributed to assess consumer knowledge of microplastics and related health risks. The recorded 832 responses were analyzed using the chi-square test in IBM SPSS 25.0 statistical software. Age, educational level, and province were the main factors contributing to consumer awareness and health risks associated with microplastics. This survey was conducted across four age categories; 16 - 25, 26 - 35, 36 - 45, and above 46, with a distribution of 34.4%, 35.6%, 16.0%, and 14.1%, respectively. Among the participants, 55% were females. Additionally, 79.6% were aware of microplastics, while 20.4% were not. A significant relationship was found between age and awareness of microplastics ($p < 0.001$). Additionally, there were differences in how respondents from various age groups ($p < 0.001$) and educational level ($p < 0.003$) identified microplastics. Participants in the 16 - 25 and 26 - 35 age groups are notably more concerned about their diets and exhibit greater awareness of food sources containing microplastics. There was a significant association between individuals' educational levels and their awareness of microplastics. The undergraduate group demonstrated a strong knowledge of microplastics. Awareness of microplastics is significantly related to respondents' age, academic level, and province, with a notable difference across different demographics. This study can guide the development of programs and materials aimed at increasing awareness of microplastics, particularly among demographics with lower awareness, to reduce the exposure to microplastics and mitigate health associated risks.

Financial assistance from Sabaragamuwa University of Sri Lanka is acknowledged.

Keywords: Awareness, Consumers, Health risks, Microplastics, Sri Lanka

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SYMP-27

CHARACTERIZATION OF MICROPLASTICS IN INDOOR AND OUTDOOR AMBIENT AIR USING PASSIVE SAMPLING METHODS: A PRELIMINARY STUDY FROM KELANIYA, SRI LANKA

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Microplastics presence in the environment is an emerging issue due to its health and environmental impacts. This study focused on the distribution, composition, and morphology of airborne microplastics in the indoor and outdoor ambient air in Kelaniya, Sri Lanka. Indoor samples were collected in a laboratory through dry deposition for 14 days, while outdoor sampling was conducted on a rooftop of a building using total atmospheric deposition for 20 days. A diverse array of microplastic forms, exhibiting varying colors were identified in both indoor and outdoor air samples by using a stereomicroscope coupled with advanced micro imaging. The highest deposition rates of synthetic fibers, ranged from 110 μm to 1600 μm were observed in the indoor air sample (3.70×10^2 fibers m^{-2} day^{-1}), whereas the lowest deposition rates of synthetic fibers, ranged from 115 μm to 2500 μm were observed in the outdoor air sample (1.08×10^2 fibers m^{-2} day^{-1}). The highest deposition rates of filaments, ranged from 230 μm to 5000 μm were found in the indoor air sample (1.64×10^2 filaments m^{-2} day^{-1}), while the lowest deposition rates of filaments, ranged from 160 μm to 1400 μm were found in the outdoor air sample (0.38×10^2 filaments m^{-2} day^{-1}). This observation may be due to the laboratory being frequently used by different groups of students, with an estimated 60 students per weekday, and its close proximity to an active construction site. The predominant shape of both samples were fibers. The identified colors in indoor air samples include transparent (35.3%), green (35.3%), red (17.6%), and blue (5.9%). In outdoor air samples, the identified colors comprise red (33.3%), black (18.5%), green (11.1%), transparent (11.1%), blue (11.1%), and yellow (3.7%). According to laser direct infrared (LDIR) technique, microplastics were composed of polyamide, polyethylene, polyurethane, polyester, polypropylene, and acrylonitrile butadiene styrene. These findings highlight the critical characteristics of airborne microplastics in urban environments, deepening our understanding of their sources, transport patterns, and potential health risks, and this knowledge is crucial for guiding policy decisions.

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Keywords: Airborne microplastics, Ambient air, Dry deposition, Total atmospheric deposition, Stereomicroscope

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