# SYMP 25

## PROCEEDINGS
## 2ND INTERNATIONAL SYMPOSIUM ON MICROPLASTICS POLLUTION

24TH OCTOBER 2025

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

## 2nd International Symposium on Microplastics Pollution – SYMP 2025

*24th October 2025*

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**BOARD OF STUDY IN ENVIRONMENTAL SCIENCE**
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**UNIVERSITY OF PERADENIYA, SRI LANKA**
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# Message from the Vice-Chancellor

## University of Peradeniya, Sri Lanka

It is with great pleasure that I extend my warm greetings to all participants of the Symposium on Microplastic Pollution 2025, organized by the Board of Study in Environmental Science of the Postgraduate Institute of Science (PGIS), University of Peradeniya.

Microplastic pollution has emerged as one of the most pressing environmental challenges of our time, affecting ecosystems, biodiversity, and human health. Academic forums such as this symposium play a vital role in advancing scientific understanding, fostering collaboration, and shaping sustainable solutions to address this global concern.

I commend the organizers for bringing together researchers, policymakers, and students to engage in meaningful dialogue and share innovative findings. Such initiatives reflect the University of Peradeniya's continued commitment to promoting research excellence and environmental stewardship.

I wish the symposium every success and look forward to the valuable contributions that will emerge from these discussions.

**Prof. Terrence Madhujith**

# Message from the Director

## Postgraduate Institute of Science (PGIS)

## University of Peradeniya, Sri Lanka

It is with great pleasure that I extend my sincere greetings to all participants of the *Second Symposium on Microplastics Pollution (SYMP2025)*, organized by the Board of Study in Environmental Science, Postgraduate Institute of Science (PGIS), University of Peradeniya, held on the 24th October 2025 at the Conference Hall, PGIS.

Microplastic pollution has become a critical global concern due to its pervasive presence in terrestrial and aquatic ecosystems, its bioaccumulation potential, and its adverse impacts on environmental and human health. Addressing this complex issue requires a strong interdisciplinary approach, integrating environmental science, chemistry, biology, materials science, and policy research to develop effective mitigation and management strategies.

As one of the leading postgraduate research institutes in Sri Lanka, the PGIS is committed to advancing high-quality scientific research that contributes to evidence-based solutions for environmental challenges. *SYMP2025* provides an invaluable platform for researchers, academics, and professionals to exchange insights, share recent findings, and foster collaborations that can guide sustainable policy and technological innovations in combating microplastic pollution.

I take this opportunity to commend the Board of Study in Environmental Science, under the leadership of Prof. Namal Priyantha, and the Organizing Committee, co-chaired by Prof. Nadeeshani Nanayakkara, for their dedicated efforts in organizing this important event. My appreciation is also extended to the Chief Guest, Prof. W. M. T. Madhujith, Vice-Chancellor, University of Peradeniya, the Keynote Speaker, Prof. Sewwandi Jayakody, Chairperson, Marine Environment Protection Council (MEPC), and all presenters and participants for their scholarly contributions.

I am confident that the discussions and outcomes of *SYMP2025* will significantly enrich the national and global discourse on microplastic research and inspire innovative approaches toward safeguarding our environment for future generations.

**Prof. N. W. B. Balasooriya**

# Message from the Chairman

## Board of Study in Environmental Science

## Postgraduate Institute of Science (PGIS)

## University of Peradeniya, Sri Lanka

I am pleased to deliver a message to mark the second Symposium on 'Microplastics Pollution (SYMP 2025)', 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 persistence, mobility and potential impacts.

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.

The presence of microplastics in the environment has been steadily increasing since 2019. There is evidence that microplastics can cross the hardy membrane protecting the brain from foreign bodies and get into the bloodstream. There is evidence that mothers may pass microplastics through the placenta to developing fetus. Micro- and nano-plastics have also been found in edible fruits and vegetables. Styrene, another chemical found in plastics, has been linked to many health issues, including nervous system problems, hearing loss and cancer. Although microplastics could be highly hazardous, there is lack of attention, understanding or remedial measures taken on this incoming severe threat.

Having realized the potential risk, the Board of Study in Environmental Science of PGIS has organized this timely and valuable Symposium, SYMP 2025, to be held on the 24th of October 2025. The major objective of the Symposium is to share the current findings on various aspects of microplastics. We all should work together to manage this threat as it could be the next disaster. Let's minimize the ways and means of producing microplastics and nanoplastics. If humans protect the environment, the environment will protect humans!

**Prof. Namal Priyantha**

# Message from the symposium Co-chair

It is with great pleasure that I welcome all participants to the *Symposium on Microplastics Pollution 2025 (SYMP 2025)*, organized by the Board of Study in Environmental Science of the Postgraduate Institute of Science, University of Peradeniya. This year's symposium, themed "Persistence, Mobility and Potential Impacts", brings together researchers, students, policymakers, and industry professionals to discuss one of the most pressing environmental challenges of our time: microplastic pollution.

Microplastics have emerged as a global concern due to their ubiquitous presence and potential to affect ecosystems, human health, and the economy. Addressing this complex issue requires multidisciplinary collaboration, technological innovation, and informed policy interventions. Through this symposium, we aim to create a vibrant platform for knowledge exchange, foster dialogue between scientific research and real-world application, and promote sustainable solutions to mitigate microplastic contamination.

The wide range of themes covered in SYMP 2025, from detection and monitoring to remedial measures and policy development, reflects the holistic approach required to confront this issue effectively. The contributions presented here not only highlight the current state of knowledge but also inspire new avenues of inquiry and cooperation among academia, industry, and government sectors.

I extend my sincere gratitude to the chief guest, keynote speaker, panellists, session chairs, authors, reviewers, and participants for their valuable contributions, and to the organizing committee for their dedicated efforts in making this event a success. It is my hope that the discussions and collaborations initiated through SYMP 2025 will lead to meaningful advancements in addressing microplastic pollution for the protection of our environment and future generations.

**Prof. Nadeeshani Nanayakkara**

# List of Abstracts

**SYMP-01**

# MICROPLASTIC POLLUTION IN URBAN WATERS OF SOUTHERN SRI LANKA

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Microplastic (MP) contamination is a global issue, and Sri Lanka is also experiencing the impacts of plastic debris pollution. This study aimed to quantify and characterize MPs in surface water and seawater in Southern Sri Lanka, with a focus on seasonal variations. Sampling was done in Gin River, Kepu Ela, Moda Ela, Galle harbour, Galle Fort and Deweta beach encompassing both Wet (April to May 2022) and Dry (June to July 2022) seasons. Five samples from each location during each season were collected, with a two-week interval between collections. After collection, the samples were prepared, and MPs were extracted using the wet peroxide oxidation method. Thereafter, MPs were identified with the aid of a dissecting microscope at 40X, 10X and 4X magnification, and counted. The highest total MPs concentration was identified in the Moda Ela upper stream in the wet season (27,666 particles/$m^3$) and in the Kepu Ela upper stream during the dry season (21,500 particles/$m^3$). Microplastic concentration was recorded as 16,750 – 23,333 particles/$m^3$ in Gin River for both seasons. The highest marine water MPs concentration of 16,250 – 19,833 particles/$m^3$ was observed in Galle Fort. Among all microplastics, the 0.3 – 0.75 mm fraction was the most common size class, while filaments were the most abundant shape. Further, it was determined that the difference between the content of MPs in wet and dry seasons was not significant ($p > 0.05$). This study confirms that microplastic contamination is prevalent in Southern Sri Lanka's aquatic environments, with consistently high concentrations across seasons and locations, highlighting the urgent need for mitigation strategies.

**Keywords:** Galle; Marine environment; Microplastics; Plastic sources; River environment

**SYMP-02**

# IMPACTS OF POLYETHYLENE TEREPHTHALATE MICROPLASTIC FIBERS ON AQUATIC MACROPHYTE *Lemna minor*

**V.S. Jayasinghe [1], H.M.T.R. Samarakoon [1*] and C.K. Hemachandra [2]**

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Plastic pollution, particularly microplastics (MPs), poses serious risks to the health and stability of freshwater ecosystems. Only a few studies have examined the effects of polyethylene terephthalate (PET) MP fibers on freshwater macrophytes, despite their high prevalence in aquatic environments. This research aimed to assess the impacts of PET MP fibers on *Lemna minor* (commonly known as duckweed). *L. minor* was collected from a pristine habitat and cultured in Steinberg medium. PET fibers, with an average length of 520±325 µm, were prepared from a PET fiber material after confirming the polymer type by Fourier Transformed Infrared (FTIR) spectroscopy. Healthy *L. minor* fronds were exposed to a series of PET fiber concentrations (i.e., 0, 10, 50, 100, 150, 200 mg/L) in Steinberg medium, with three replicates per concentration (n=12 fronds per replicate) in glass jars, using a static renewal system with media renewal on every other day, for seven days with a 12/12-hour light/dark cycle. The number of fronds in each replicate was recorded daily. At the start and the end of the exposure period, measurements were taken for root length, fresh and dry weights, frond area, and chlorophyll a and b contents in fronds exposed to different treatments and controls. The results indicated that the frond area was significantly reduced by PET fiber concentrations at ≥50 mg/L (>44.9% compared to the control) ($p$<0.05, one-way ANOVA), and the average frond number, wet weight, and chlorophyll a contents were significantly reduced at ≥150, ≥100, 200 mg/L, respectively ($p$<0.05, one-way ANOVA). However, the root length, dry weight, and chlorophyll b content were not significantly affected during the test period. These findings underscore the potential of PET MP fibers to disrupt aquatic plant health and compromise the stability of freshwater ecosystems as *L. minor* serves as a model macrophyte influencing nutrient cycling and habitat quality, causing effects scale up to the ecosystem level.

**Keywords:** Aquatic macrophytes; Freshwater ecosystems; *Lemna minor*; Microplastic pollution

**SYMP-03**

# ABUNDANCE OF MACRO LITTER AND MICROPLASTIC IN WATER AND SEDIMENT IN NEGOMBO ESTUARY, SRI LANKA

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The problem of plastic pollution is becoming increasingly serious throughout the world. In the Negombo Estuary of Sri Lanka, both macro plastics and microplastics (MPs) pollution negatively impact the environment and reduce its economic value**.** This study examines the amount, distribution, and sources of macro litter and the abundance of MPs in water and sediments of the Negombo Estuary. Samples were collected from November 2024 to February 2025, with sampling conducted at 21 locations across 17 GN divisions. Standard Oslo and Paris Convention protocol was followed to assess macro litter, categorizing litter by type, source, and recording counts and weight with brand identification where possible. For the MPs analysis, 30 L of surface water and 400 g of sediment were taken, followed by digestion, density separation, filtration, and stereomicroscopic identification. By weight, the highest macro litter polluter in urban areas was the beverage industry (0.276 Kg/m²), while by count, it was the food industry (0.17 litter/m²). Coca-Cola® waste was most common in macro-litter. Microplastics (200 µm–5 mm) were analyzed with Kruskal-Wallis and Spearman correlation methods. MPs level in surface water showed a significant difference among Location 18 (Dungalpitiya GN division, a vegetated area) with 1.20 ± 0.15 MPs/L, Location 6 (Kepungoda GN division, a seaward area) with 0.11 ± 0.10 MPs/L, and Location 21 (Siriwardana Pedesa GN division, a populated area) with 0.16 ± 0.02 MPs/L. However, no significant difference was found in sediment samples (Kruskal-Wallis $p > 0.05$). In sediment, fragments were the most common MP by shape (35.8%), while fibers (67.5%) dominated in water. Blue was the most common colour of the MPs in both sediment (32.8%) and water (41.5%). Here no correlation between MPs with TS and TDS. This study shows serious plastic pollution in the Negombo Estuary, urging better waste management and awareness.

**Keywords:** Negombo estuary; OSPAR; Plastic pollution; Water quality

*Acknowledgements: This study was funded by the Ocean Country Partnership Program (OCPP), UK*

**SYMP-04**

# INFLUENCE OF SEDIMENT CHARACTERISTICS ON VISIBLE MICROPLASTIC DISTRIBUTION IN BEACH SEDIMENTS

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Microplastic (MP) pollution in coastal sediments poses an escalating environmental threat due to its durability and ecological consequences. However, the accumulation of visible MPs (plastic particles 1–5 mm) on Sri Lankan beaches remains poorly understood, especially in relation to how sediment properties affect their distribution. This study investigates the relation between visible MP concentration and sediment characteristics at five beaches (Bentota, Wadduwa, Wellawatta, Kepumgoda, and Chilaw) along the west coast of Sri Lanka. Sediment samples were collected from three beach zones (supralittoral, littoral, sublittoral) at each site during March and May 2025. Nine samples were collected at each site, making a total of 45 samples across all sites, using a 25 cm × 25 cm quadrant to a depth of 2 cm. MPs were extracted by density separation and categorized by type and size through microscopic observation. Sediment grain size analysis was conducted using sieve analysis, and mean grain size and sorting index were calculated using the Folk and Ward graphical method. Results showed substantial spatial variation in MP concentrations. Wellawatta recorded the highest concentration (22 ± 13 items/m²), while Kepumgoda had the lowest (6 ± 8 items/m²), followed by Wadduwa, Chilaw, and Benthota in descending order. Statistical analysis using the Kruskal–Wallis test showed significant differences in MP concentrations among sites ($p = 0.0347$, $p < 0.05$), indicating statistically meaningful spatial variation. Fragments were dominant at all sites, while foam particles were also common. No significant correlation was found between MP concentrations and sediment characteristics (mean grain size, sorting index) possibly due to limited sample size. Overall, Spearman's rank analysis indicated very weak associations with mean grain size ($r = +0.037$, $p = 0.8086$) and sorting index ($r = -0.017$, $p = 0.909$). These findings suggest that sediment characteristics do not influence visible MP accumulation which is likely to be more affected by hydrodynamic processes and human activities.

**Keywords:** Microplastics; Sediment sorting; grain size; Sediment Characteristics; Westcoast

**SYMP-05**

# COMPARATIVE ANALYSIS OF MICROPLASTIC CONTAMINATION LEVELS IN INDIAN BACKWATER OYSTERS (*Crassostrea madrasensis*) AT KALPITIYA LAGOON AND PANADURA ESTUARY, SRI LANKA

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Microplastics (MPs) are small particles, defined as less than 5mm in size. It is a major source of pollution and common waste material in marine and coastal environments. This study focuses on evaluating MP pollution in Indian Backwater Oysters (*Crassostrea madrasensis)*, sediments and surface water samples at the Kalpitiya Lagoon and the Panadura Estuary during February and April 2025. Five composite oyster samples, along with three samples each of sediment and surface water, were collected from both locations using a random sampling method and processed through digestion, density separation, and filtration, followed by microscopic identification. The results showed that, on average, oysters contained 1.10 ± 0.28 particles/g, sediments were contaminated with 14.20 ± 4.46 particles/100 g, and surface water contained 87.33 ± 23.92 particles/L across both locations. The predominant MP type was the fiber (49% in Panadura and 40% in Kalpitiya) in all sample types at both locations, with black particles (74% in Panadura and 63% in Kalpitiya) being the most common colour. The Panadura Estuary exhibited higher MP levels in oysters (1.27 ± 0.22 particles/g) and surface water (104.67 ± 21.57 particles/L). Kalpitiya Lagoon had a higher MP level in sediments (16.67 ± 5.22 particles/100g). Further, the results revealed significant differences in MP abundance among sample types within each location. Surface water consists of the highest MP levels, followed by sediments and oysters. One-way ANOVA confirmed these differences were significant for both Panadura Estuary ($F = 92.81$, $p < 0.001$) and Kalpitiya Lagoon ($F = 200.67$, $p < 0.001$). However, two-sample t-tests comparing MP abundance between the Panadura Estuary and the Kalpitiya Lagoon revealed no statistically significant differences for oysters, sediments, or surface water. These results indicate MP contamination levels between the two locations were similar, and that MP pollution was widespread in both locations. Indian Backwater Oysters were vulnerable to MP ingestion, making them useful bio-indicators and highlighting potential risks to seafood safety and ecosystem health. This study highlights the need for improved plastic waste management and monitoring, as promoting proper waste practices and reducing plastic use can help minimize MP contamination in seafood, protect public health, and mitigate impacts on marine ecosystems and coastal communities.

**Keywords:** Kalpitiya Lagoon; Microplastics; Oyster; Panadura estuary; Sediment; Surface water

**SYMP-06**

# ENVIRONMENTAL AND HEALTH IMPACTS OF IMPROPER PLASTIC WASTE DISPOSAL IN A COASTAL FISHING COMMUNITY IN GURUNAGAR, JAFFNA, SRI LANKA

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Plastic waste has become a significant concern for coastal ecosystems and the health of lagoon communities, particularly those that rely on fisheries for their livelihood. This study explored improper waste disposal practices in the Gurunagar coastal area of Jaffna during January 2022 and January 2023. Data were collected through community clean-up activities, direct field observations, focus group discussions, and a structured household questionnaire administered to 150 participants (90 males and 60 females). The questionnaire addressed demographic information, patterns of waste generation and disposal, level of awareness of pollution issues, and related health concerns. Statistical analyses were performed using descriptive methods and chi-square tests in Excel and SPSS. Findings revealed that 72% of respondents disposed of waste through open dumping or direct discharge into coastal waters, largely due to the absence of an organized waste collection system. Significant correlations were observed between residents' proximity to dumping sites and reported cases of respiratory ($\chi^2 = 6.21$, $p = 0.013$) and gastrointestinal illnesses ($\chi^2 = 5.84$, $p = 0.016$). Field observations further documented extensive plastic accumulation, aesthetic degradation, and pollution hot spots. As 80% of residents regularly consume locally caught fish, the findings suggest potential exposure to microplastics through the food chain. The study underscores the urgent need for systematic waste management, community education, and targeted policy interventions to reduce plastic pollution and its health impacts in coastal Sri Lanka.

**Keywords**: Plastic pollution; Coastal community; Health impacts; Waste management; Microplastics.

**SYMP-07**

# MICROPLASTIC CONTAMINATION IN DRIED FISH FROM NEGOMBO, SRI LANKA

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Microplastic (MP) contamination in seafood is a growing environmental and food safety concern, yet evidence from developing countries remains limited. This study presents the first systematic assessment of MPs in dried fish from Negombo, Sri Lanka, where it is a major dietary and economic resource. A total of 27 dried fish samples were collected from three processing sites: Negombo Dry Fish Processing Area (Site 1), Traditional Catamaran Harbor (Site 2) and Daluwakotuwa (Site 3), representing three species: *Sardinella* spp*., Selar crumenophthalmus,* and *Balistapus* spp. based on morphological identifications. Samples were digested using a standardized hydrogen peroxide wet oxidation protocol to remove organic matter, followed by vacuum filtration. Suspected particles were examined under a stereo microscope and classified by size, shape, and colour. Microplastics were detected in all samples, with the abundance ranging from 2.35 to 5.05 MPs/g. Dried fish samples collected from Site 1 recorded the highest mean concentration (4.03 ± 0.39 MPs/g), likely linked to its proximity to intensive fishing activity and urban settlements, while Site 3 showed lower averages (3.23 ± 0.77 MPs/g) but greater variability in terms of the range of MPs present, suggesting sporadic contamination or environmental differences. Among species, *Sardinella* spp. contained the highest levels of MPs (3.994 MPs/g), reflecting its filter-feeding behaviour and greater exposure to suspended particles. Fragments (83%) were the dominant MP type, followed by fibers (7%) and films (5%), while red (23%) and black (43%) MP particles were the most common colours. These patterns point to multiple contamination pathways, including polluted marine environments, fishing gear, and processing practices. The consistent detection of MPs in a widely consumed product highlights potential risks to food safety and public health. This baseline study underscores the need for improved monitoring, safer processing practices, and stronger policies to reduce plastic pollution. Expanding research across more species, sites, and seasons will provide a clearer understanding of contamination patterns and help safeguard seafood quality in Sri Lanka.

Keywords: Dry fish; Food Safety; Human Health; Microplastics; Negombo; Seafood

**SYMP-08**

# NEUROINFLAMMATORY RESPONSES TO MICROPLASTIC EXPOSURE IN HUMAN IPSC-DERIVED BRAIN ORGANOIDS AND NEURAL MODELS: A SYSTEMATIC REVIEW OF MECHANISTIC AND TRANSCRIPTOMIC EVIDENCE

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Microplastic (MP) exposure is increasingly recognized as a neurotoxic environmental threat, yet evidence from human-relevant models remains limited. This systematic literature review evaluates neuroinflammatory responses to MP exposure using human induced pluripotent stem cell (iPSC)-derived brain organoids and neural models, focusing on mechanistic insights derived from cytokine profiling and single-cell transcriptomics. A structured search was conducted in MEDLINE, ScienceDirect, and Google Scholar for English-language peer-reviewed studies published between 2020 and 2025. Boolean operators and MeSH terms were applied using the search string: ("microplastics" OR "nanoplastics") AND ("iPSC-derived brain organoids" OR "human neural organoids") AND ("neuroinflammation" OR "cytokines" OR "oxidative stress" OR "glial activation") AND ("single-cell RNA sequencing" OR "transcriptomics"). The systematic review adhered to PRISMA-P 2020 guidelines. Only human-related *in vitro* studies involving iPSC-derived organoids, neural stem cells, or CNS-relevant human neuronal models were included. Articles underwent peer review, and both primary and relevant secondary literature were considered. Zotero was used as the reference management tool to organize and screen eligible studies. Findings revealed that MPs, particularly polystyrene-based particles <2 μm, can cross the blood-brain barrier and trigger significant neuroinflammatory cascades. This includes microglial overactivation, elevated release of IL-6, TNF-α, and IL-1β, increased oxidative stress (ROS), and disruption of neuronal microtubules. Advanced tools like scRNA-seq identified upregulation of immune and apoptotic gene signatures, linking MP exposure to neurodevelopmental and neurodegenerative pathologies such as autism and Alzheimer's disease. Fluorescence microscopy, electron microscopy, and cytokine assays further validated these inflammatory and structural alterations. Therefore, integration of brain organoid platforms with organ-on-a-chip systems could enable more physiologically relevant modeling of MP-induced neurotoxicity, improving predictive power for human health outcomes. This approach guides environmental policy, informs public health, and supports neuroprotective strategies to reduce pollution-linked neurological disease.

**Keywords**: Brain organoids: Microglia; Microplastics; Neuroinflammation.

**SYMP-09**

# DETECTION OF AIRBORNE MICROPLASTICS IN HUMAN LUNG BIOPSIES USING CONFOCAL LASER SCANNING MICROSCOPY AND CORRELATIVE ELECTRON MICROSCOPY: A SYSTEMATIC REVIEW

**M.S.N. Alwis [1], H.M.A.M. Hennayake [1], P.A.O.K. Panagoda [1*], D.M.D.D. Dissanayake [1] and T.D.D.T. Tennakoon [2]**

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Airborne microplastics (MPs), defined as synthetic polymeric particulates <5 mm, have emerged as pervasive environmental contaminants with potential pathophysiological consequences for the human respiratory system. Despite growing concern, there are few detailed studies on the exact amount and tissue distribution of MPs in the lungs, partly due to the limitations of common detection methods like Fourier-transform infrared (FTIR) spectroscopy. This systematic review critically evaluates the application of advanced imaging techniques, such as confocal laser scanning microscopy (CLSM) and correlative electron microscopy (CEM); for the *in-situ* identification and characterization of airborne MPs in human lung biopsy samples. Employing a rigorous search strategy across MEDLINE and Google Scholar (2013–2025), we applied MeSH terms and Boolean operators encompassing "airborne microplastics," "lung biopsy," "confocal microscopy," and "correlative electron microscopy." Adhering to PRISMA 2020 guidelines and a PICO-formulated research question, a comprehensive screening process identified studies fulfilling stringent inclusion criteria emphasizing human tissue analysis and imaging-based MP detection. Data extraction followed a predefined protocol to ensure reproducibility and minimize bias. Results demonstrate a bimodal MP size distribution, fibrous particles predominating in the 100–2,475 µm range and fragmented MPs between 1–20 µm, predominantly localized in lower lung lobes. Confocal laser scanning microscopy, enhanced by Nile Red fluorescent staining, achieved superior spatial resolution and reduced false-positive rates by 62% compared to FTIR. Correlative electron microscopy facilitated ultrastructural localization of MPs, enabling correlative morphological and compositional analyses. Collectively, CLSM and CEM identified approximately 20% more MPs <50 µm than conventional spectroscopic methods. This systematic review underscores the technological superiority of CLSM and CEM in resolving pulmonary MP burden at clinically relevant scales and advocates for standardized imaging protocols, nanoscale characterization advancements, and policy initiatives to mitigate inhalational MP exposure, particularly in urban and occupational settings.

**Keywords:** Airborne microplastics; Confocal laser scanning microscopy; Correlative electron microscopy; Lung tissue.

**SYMP-10**

# IMPACT OF POLYSTYRENE MICROPLASTICS ON HUMAN SPERM FUNCTION AND DNA INTEGRITY: A SYSTEMATIC REVIEW

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Polystyrene microplastics (PS-MPs) and nanoplastics (PS-NPs) are environmental contaminants with growing evidence linking them to male reproductive toxicity. Recent detection of MP fragments in human seminal fluid has raised concern on their potential effects on sperm function, DNA integrity, and overall male fertility. This systematic literature review was conducted in accordance with PRISMA 2020 guidelines. Systematic Literature search was performed in ScienceDirect, MEDLINE, and Google Scholar for studies published between 2020 and 2025 using MeSH-based search strategies. Both human and animal peer-reviewed studies in English were included. Non-polystyrene, and duplicate records were excluded. A total of eligible studies consistently reported that PS-MPs/NPs exert cytotoxic and genotoxic effects on sperm. *In vitro* and *in vivo* studies consistently show that PS-MPs impair core measures of sperm quality. Across experiments, sperm vitality and motility decline in a clear, dose-dependent fashion, often accompanied by head-to-head agglutination. Although morphology remains unchanged in cell-culture systems, animal models reveal lower sperm counts and more abnormal forms after exposure. Mechanistic data converge on oxidative-stress-driven cellular damage: DNA fragmentation rises, genomic stability and mitochondrial function fall, the blood–testis barrier becomes leaky, and key sperm–oocyte-fusion genes (e.g., IZUMO1, DCST1/2) are consistently down-regulated. Recent work further confirms that PS-MP/NP exposure compromises human sperm functionality and DNA integrity through oxidative stress, genotoxicity, and disrupted molecular pathways. Clinically, these changes correlate with infertility, testicular damage, impaired fertilization, early embryonic defects, and even potential transgenerational impacts. Collectively, the evidence indicates that PS-MPs jeopardize male reproductive health through multifaceted, oxidative-stress–centred mechanisms documented by an array of advanced analytical techniques. Microplastic exposure appears to harm male fertility by reducing sperm function and genetic integrity and altering key gene expression, however, the current evidence is limited to high-dose laboratory and animal studies. Human studies at real-world exposure levels are now needed to define health risks and guide the development of biomarkers and preventive measures.

**Keywords:** Polystyrene microplastics; Sperm DNA fragmentation; Male infertility; Oxidative stress; Reproductive toxicology.

**SYMP-11**

# MICROPLASTIC CONTAMINATION IN STREET FOODS AT GALLE FACE GREEN, COLOMBO, SRI LANKA

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Microplastics (MP) are now ubiquitous, their presence in common food items can no longer be neglected. However, in Sri Lanka, studies to investigate occurrence of MP in common foods such as street foods are extremely limited. This study aimed to investigate the occurrence and characterization of MP contamination in street foods at Galle Face Green, which is a critical urban recreational hub in Colombo, Sri Lanka. The research used quantitative method of data collection. Thirty street food samples comprising of seafood-based prawn fritters (*isso* wade) and non-seafood bread (roti) were collected from five selling points and analyzed using oxidative digestion with 30% $H_2O_2$. Density separation was done with saturated NaCl solution, and vacuum filtration through 1.2µm Glass microfiber filters, fat reduction was completed using acetone. Results revealed an average MP abundance of 0.5921 ± 0.3489 particles/g among all samples. Prawn fritters showed significantly higher contamination (0.8313 ± 0.3386 particles/g) compared to non-seafood bread (0.3528 ± 0.1220 particles/g) ($t$ = -5.15, $p < 0.001$). Black particles were dominated the color composition (31%) followed by blue and transparent particles (18% each). Fragments were the most common morphological type particularly abundant in prawn fritter samples followed by fiber and film. There is no significant spatial variation in contamination levels of MPs among sampling points (One-Way ANOVA, $p = 0.542$), indicating uniform distribution of MP pollution throughout the study area. Correlation analysis indicated that there were no significant correlations among the sample weight and MPs in non-seafood bread ($r = -0.445$, $p = 0.097$) and prawn fritters ($r = 0.393$, $p = 0.147$), confirming that MP abundance is not directly dependent on sample weight. This is the first study in MP identification in street foods, and it establishes baseline data for MP contamination in Sri Lankan Street foods and highlights seafood-based items as a significant pathway for dietary microplastic exposure.

**Keywords:** Galle Face Green; microplastics; Processed foods; Street foods; Urban pollution

**SYMP-12**

# METHOD OPTIMIZATION FOR ASSESSING MICROPLASTIC CONTAMINATION IN MARINE MACROALGAE

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Microplastics (MPs) are a prevalent environmental pollutant in marine ecosystems; however, studies on their contamination in local marine algae remain limited. Therefore, this study aimed to develop a reliable analytical method to identify and quantify MPs in macroalgae, using *Ulva intestinalis* as the model species due to its widespread global distribution. *Ulva intestinalis* was collected from the western coast of Sri Lanka. Following the National Oceanic and Atmospheric Administration (NOAA) method with some modifications, a new optimized method was developed for the extraction and analysis of MPs from macroalgae. Collected *U. intestinalis* were rinsed with distilled water, and the rinsing water was analyzed to identify and quantify externally attached MPs in macroalgae. To identify and quantify internally retained MPs, the rinsed macroalgae samples were dried at 60 °C for 24 h and subjected to alkaline digestion with a 10% KOH. The sample-containing solution was initially placed on a hotplate at 60 °C for 4 h and then left to digest for 3–5 days. Both the digested material and rinsed water were filtered using 0.45 µm membrane filters and examined for MPs using a stereomicroscope. The results showed the presence of MPs as both externally attached and internally retained in macroalgae samples, revealing contamination in *U. intestinalis*. Microfibers were identified as the most dominant MP across all samples, with an abundance of 3.20±0.58 MPs/g internally and 0.91±0.28 MPs/g externally. Internally retained MPs included blue, black, transparent, green, red, and purple microfibers, with transparent being dominant, while externally attached MPs consisted mainly of black, blue, transparent, and red microfibers, with black as the predominant colour. The study confirms that *U. intestinalis* was contaminated with microplastics both externally and internally, with microfibers as the dominant form. The experiment established a reliable analytical method for the extraction, identification, and quantification of MPs in macroalgae, which can be applied in future studies.

**Keywords:** Microplastics; Microfibers; Macroalgae; *Ulva intestinalis;* Method optimization

**SYMP-13**

# MICROPLASTICS IN URBAN ROAD DUST AND BUILD-UP AIR

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Microplastic (MP) pollution is an environmental concern, threatening human health and ecosystems due to its persistence. MPs are synthetic polymer particles smaller than 5 mm, typically originating from degraded plastic debris and the shedding of synthetic textile fibres. Road dust is a major source of MPs in urban environments, particularly in high-traffic areas, as it can be resuspended and transported long distances. However, limited research has compared MPs in road dust and build-up air samples. This study investigates the presence of MPs and pollutant load in road dust and build-up air in urban areas of Kandy, Sri Lanka. Samples were collected from two congested indoor and outdoor vehicle parking areas during the dry season, along with background data including traffic intensity, road surface texture depth, and prevailing weather conditions. Eight road dust samples and two air samples were collected during weekday morning peak hours. From an indoor vehicle park, three samples were collected from areas designated for four-wheelers, three-wheelers, and two-wheelers to evaluate vehicle-type influence. Road dust samples were sieved into three size fractions and analysed for Total Suspended Solids (TSS), organic matter content, and MPs. Airborne particulates were collected using a high-volume air sampler and analysed for PM10 and MPs. Results showed the presence of MPs in all samples. Microplastics of various colours and shapes (fragments, films, and fibres) were observed, under 300 µm, with black as the dominant colour. Indoor samples showed higher TSS loads, while outdoor samples exhibited higher MP concentrations. Two-wheeler parking areas accumulated higher MPs and organic matter per area than other vehicle types. Airborne MPs shared similar shapes and colours with road dust, with particle sizes below 500 µm. This study provides insights into MP accumulation patterns in urban environments, highlighting the need for further research on transport pathways and environmental risks.

**Keywords:** Airborne Microplastics; Dry Period; Microplastics; Road Deposited Dust; Urban Pollution.

**SYMP-14**

# UTILIZING *Sansevieria trifasciata* FOR SIMULTANEOUS BIOMONITORING AND BIOREMEDIATION OF AIRBORNE MICROPLASTICS IN INDOOR ENVIRONMENTS

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Indoor environments are hotspots of airborne microplastic (MP) pollution. This study evaluates the common ornamental plant *Sansevieria trifasciata,* renowned for its air-purifying qualities, as a simple, sustainable tool for the dual purpose of biomonitoring and bioremediation of airborne MPs. Thirteen plants were kept in four different indoor environments at the University of Kelaniya, Sri Lanka: a print shop, an office, a laboratory, and a lecture hall with three replicates per location. A single plant housed in a sealed glass chamber served as the control. MP deposited on and captured by leaf surfaces were analyzed using stereomicroscopy and advanced microimaging, and quantified by count, size, colour, and shape. Additionally, a subsample of leaves was subjected to chemical digestion to isolate and identify MPs incorporated within the leaf tissues. Results revealed deposition gradient; the print shop exhibiting the highest MP concentration (0.099 n/cm²), followed by the office (0.094 n/cm²), laboratory (0.050 n/cm²), and lecture hall (0.045 n/cm²). The control confirmed that the MPs originated from the local environment. Fibers were the predominant morphology across all sites. MPs were not only detected on leaf surfaces but also observed within the internal leaf tissues in three plants, indicating possible translocation and internal accumulation. Future studies comparing *S. trifasciata* with other common indoor plants are recommended to confirm and expand the understanding of its air-purifying potential.

**Keywords:** *Sansevieria trifasciata*; biomonitoring; bioremediation; Microplastics; Indoor air pollution

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## SYMP-15

# SPATIAL AND TEMPORAL DISTRIBUTION OF AIRBORNE MICROPLASTICS IN INDOOR ENVIRONMENTS

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Airborne microplastics (MPs) in indoor environments pose a growing concern, as people spend most of their time indoors, increasing the likelihood of inhalation. Emerging evidence suggests that these particles may induce respiratory and systemic health effects. This study investigated the abundance, distribution, and morphology of airborne MPs in four distinct indoor environments at the University of Kelaniya, Sri Lanka: a student dormitory, cafeteria, study area, and printing shop. Passive dry deposition sampling was conducted over four weeks, with 24-hour collections on both a weekday and a weekend day each week. Microplastics were analyzed using stereomicroscopy, which revealed a diverse array of sizes and colours. The dormitory exhibited the highest deposition rate ($16.72\times10^3$ MPs $m^{-2}$ $day^{-1}$), followed by the study area ($7.73\times10^3$), cafeteria ($4.17\times10^3$), and printing shop ($2.92\times10^3$). Overall, approximately 54% of MPs were deposited on weekdays and 46% on weekends. The dormitory was the dominant source on both weekdays (40.9% of total weekday deposition) and weekends (36.8%). Notably, the printing shop's contribution increased substantially on weekends (18.7%) compared to weekdays (6.3%), reflecting varying patterns of student activity. Blue fibers were the most prevalent type (52.0%), followed by black (18.0%) and red (12.9%). Most MPs were large, with 44.3% in the 1000–2000 μm range and 30.5% in the 500–1000 μm range. These findings confirm the pervasive presence of MPs in indoor environments and underscore the urgent need to evaluate potential health risks from long-term inhalation exposure.

**Keywords:** Airborne microplastics; Dry deposition; Indoor air quality; Morphology; Passive sampling; Temporal variation

*Acknowledgement: Financial assistance by the University of Kelaniya (Grant no. RP/03/02/06/03/2023).*

**SYMP-16**

# SOLAR-POWERED, LOW-COST GPS SOLUTION FOR TRACKING FLOATING PLASTIC WASTE IN SMALL WATER BODIES

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Plastic pollution poses a major threat to aquatic ecosystems, with urban waterways serving as conduits for debris entering larger water bodies. Monitoring floating plastics in small waterways remains a challenge, as conventional methods such as satellite imagery and manual surveys are costly and often inaccessible. This study presents a low-cost, solar-powered GPS-enabled device designed to track the movement of floating plastic waste in small urban water bodies, thereby addressing a critical gap in monitoring macro-plastics that ultimately fragment into microplastics. The unit, enclosed in a waterproof 2-liter plastic bottle, integrates a GPS module (±5 m accuracy), rechargeable lithium-ion batteries, a battery management system, and a solar panel. It weighs 400 g and can operate for 30 h without solar input and up to 72 h with solar charging. Charging requires 2.5 h via electricity or 6−8 hours under sunlight. The device functions reliably in temperatures from -20 °C to +55 °C. Field deployment in Beu Ela canal, Kurunegala, Sri Lanka, revealed flow rates ranging from 4.5 to 14.2 m/min under normal conditions, rising to 21.9 m/min during rainfall. GPS tracking showed consistent debris movement patterns, with multiple trapping points under normal flow, whereas rainfall increased flow speed, reduced trapping points, and caused denser waste accumulations. Commonly observed debris included plastic bottles, shopping bags, and organic matter. The device maintained strong waterproofing and delivered accurate results throughout testing. These findings demonstrate the importance of hydrological conditions in debris transport and highlight the potential of adaptable, low-cost technologies for integrated macro- and microplastic pollution monitoring. Future improvements will focus on enabling real-time data transmission and automated debris detection for broader environmental applications.

**Keywords:** Floating plastic waste; GPS tracking device; Plastic pollution, Solar powered

**SYMP-17**

# MICROPLASTIC CONTAMINATION IN SEA SALT OF SRI LANKA AND REMEDIAL MEASURES

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The marine environment is considered the largest plastic dump in the world. In Sri Lanka, salt is produced by the evaporation of seawater. Therefore, sea salt could be contaminated with microplastics (MPs). As MP contamination poses a significant risk to food safety in South Asia, it is essential to study its presence in Sri Lankan salt. This study investigates the contamination status and characteristics of MP isolated from sea salt in Sri Lanka, as well as a low-cost remediation technique. Samples included six powdered salt brands, five crystal salt brands, water from the Puttalam Lagoon, and raw salt. To extract MPs in salt, 100 g of salt was digested with 30% $H_2O_2$, followed by dissolving in 800 ml of filtered distilled water, and filtration through 0.45 µm filter papers. As a remedial measure, a clay-based filtering system was used to test the efficacy of MP removal by filtering 800 mL of saltwater samples. Identification and confirmation of MP was performed using a stereo microscope with the hot needle test. The results revealed that all the tested samples were contaminated with MP. The average MP concentrations in powdered, crystal, and raw salt were 751.30±122.09, 424.67±108.09, and 1456.67±142.95 MP items/kg, respectively, while seawater recorded 1.51±0.05 MP items/L. Transparent MPs (71.2%) were dominant in edible salt, while fibers comprising most shapes (94.8%). The tested low-cost clay-based filter effectively removed 87.0% of MP and recorded only 13.0% fiber types identified in the filtrate. The study concludes that all the tested sea salt samples are contaminated with MPs, and the contamination likely occurs both through contaminated water and during production. The clay-based filter system could be an effective method for removing MPs from sea salt and seawater, thereby helping to minimize MP ingestion rates. This study can be beneficial for salt producers, consumers, and other stakeholders to be aware of MP contamination levels, pathways, and potential remedial measures in salt production.

**Keywords:** Plastics; Powdered salt; Crystal salt; Raw salt; Clay-based filter; Hot needle test

*Acknowledgements: Department of Aquaculture and Fisheries, Faculty of Livestock, Fisheries, and Nutrition, Wayamba University of Sri Lanka.*

**SYMP-18**

# ENVIRONMENTAL DEGRADATION OF MICRO PLASTICS INTO NANO PLASTICS: A REVIEW OF ITS MECHANISMS, IMPLICATIONS, AND MITIGATION

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Environmental degradation of plastic into microplastics (MPs) and subsequently nanoplastics (NPs) is a vital process of plastic pollution, which is critical for ecological wellbeing. This brief review aims to comprehensively synthesize the existing knowledge on the mechanisms of degradation of MPs into NPs, implications, and mitigation challenges of NP pollution. As revealed by pyrolysis-gas chromatography and Raman spectroscopy, fragmentation potentially converting a 1 cm particle into $10^{17}$ NPs, is fuelled by abiotic factors such as ultraviolet radiation, implying photodegradation, mechanical abrasion, hydrolysis, and biotic processes including microbial activities of enzymatic digestion. Mechanical forces generated in wastewater treatment plants and natural soil are critical in decaying MPs into NPs. Weathered plastics fragment, releasing NPs with altered physical and chemical properties, including lower crystalline and additive leachates. Due to their high surface area-to-volume ratio, NPs (<100 nm) exhibit extreme behaviour compared to MPs. This significantly increases their bioavailability by 10–100 times, allowing enhanced penetration through the biological membranes like the intestinal, blood-brain, and placental barriers. They also serve as vectors for other pollutants. This degradation process is complex and depends on the polymer type, environmental factors, and prior ageing. Enzymatic biodegradation of polymers not only serves as a degradation mechanism but also contributes to the formation of secondary NPs. Characterization of NPs remains a challenge due to their polydispersity and complexity of the environmental matrices, which can interfere with the accuracy of risk assessments. Improved detection methods, such as field-flow fractionation and inductively coupled plasma mass spectroscopy, along with effective mitigation policies and robust regulatory frameworks, are urgently required in environments where the pervasive generation of NPs occurs, such as wastewater treatment plants and agricultural soils. This review underscores the importance of immediate action on integrated approaches for characterization, life cycle assessment, environmental impacts, and health risks, along with sustainable plastic design and persistent waste management strategies to address the evolving challenges of nanoplastic pollution.

**Keywords:** Biodegradation; enzymatic; Nano plastics; Photodegradation

**SYMP-19**

# MICROPLASTICS RELEASED FROM TOOTHBRUSHING

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Microplastic (MP) pollution is now an issue of major environmental and health concern, yet limited attention has been given to personal care items such as toothbrushes. This study investigates the release of MPs from toothbrushes during routine usage, combining laboratory simulations with human brushing trials and a nationwide survey in Sri Lanka. Three widely used toothbrush brands were tested under controlled brushing conditions using both an artificial dental model and saliva samples collected from volunteers. Stereomicroscopy was used to measure physical properties of the microplastic particles (size, shape, and colour), and Raman and FTIR spectroscopy were used to identify polymer composition. Findings indicated a significantly greater emission of microplastics in the first week of use because of initial wear on the bristles. Most of the particles were fibers that were between 0.1 - 0.2 mm in diameter and chemically identified as polypropylene (PP) and nylon blends. According to a survey conducted among 846 respondents in Sri Lanka, the frequency of replacement of toothbrushes is every three months. With this, it is estimated that the Sri Lankan population produced 970.5 metric tons of discarded plastic waste each year, which contributes to the further spread of MP pollution. These results highlight toothbrushes as an overlooked yet significant source of MPs, both during use and in their disposal. The study highlights the importance of sustainable substitutes, improved waste treatment, and public awareness to mitigate environmental effects and health impacts. Future research should address nano-plastic emissions and evaluate biodegradable toothbrush materials for safer and more sustainable oral care practices.

**Keywords**: Microplastics; Toothbrush; Polypropylene; Nylon; Raman Spectroscopy; FTIR

**SYMP-20**

# MICROPLASTIC REMOVAL FROM WATER: INFLUENCE OF SOLUBILITY FACTORS AND EFFICACY OF SAND FILTRATION

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Contamination of microplastics (MPs) in water systems poses significant environmental and health risks, necessitating efficient and cost-effective remediation techniques. This study examines the solubility dynamics of MPs in water under varying conditions and evaluates sand filtration as a practical solution for mitigating MP pollution in contaminated water. This research investigates the effects of pH, organic co-solvents (acetone, ethyl acetate, diethyl ether, ethanol), and surfactants (cationic, anionic, amphoteric) on MP solubility, alongside the performance of sand filtration for removing MPs of different size ranges. MP samples were prepared from ground polyvinyl chloride (PVC), and solubility was tested under acidic, neutral, and basic pH conditions, with co-solvents and surfactants. Sand filtration experiments utilized silica sand with different grain sizes, with removal efficiency measured via mass analysis and stereomicroscopic inspection. Findings indicate that pH and surfactants have a negligible effect on MP solubility, while organic co-solvents, notably acetone, significantly enhance solubility due to improved interactions with hydrophobic MPs. Sand filtration demonstrated exceptional performance, achieving 100% removal efficiency for MPs across all sizes with 250 µm sand grains, 88% efficiency for ≤250 µm MPs, and 96% for 250–500 µm MPs with 250–500 µm sand grains, and 93% for ≤250 µm MPs with 500–1000 µm sand grains. Finer sand grains (250 µm) exhibited superior retention compared to coarser grains (250–500 µm, 500–1000 µm), as confirmed by microscopic analysis showing no MPs in filtrates. The study concludes that sand filtration is a cost-effective, efficient method for removing MPs larger than 250 µm, with filtration efficiency tied to sand grain size. The hydrophobic properties of MPs restrict their solubility in water; however, the introduction of organic co-solvents markedly enhances their solubility by facilitating increased interactions with the hydrophobic matrix, offering insights into MP behaviour in aqueous environments. Practical recommendations include adopting layered sand filter designs with varied grain sizes to optimize retention and flow, integrating pre-treatment methods such as coagulation-flocculation, and implementing regular backwashing to maintain filter performance. These findings provide recommendations for wastewater treatment facilities to address MP pollution effectively.

**Keywords**: Co-solvents, Microplastics, Sand filtration, Solubility, Water purification

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