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1º Simpósio Internacional de Microplásticos em Ecossistemas Aquáticos

1st International Symposium on Microplastics in Aquatic Ecosystems

INTEGRATED EVENT

1st Workshop on Nuclear Collection, Characterization and Applications for Microplastic Mitigation (NuclearMicro)

Santos, São Paulo, Brazil • June 9-13, 2026

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EcoFaxina Institute

Nuclear and Energy Research Institute (IPEN/CNEN)

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APRESENTAÇÃO

Santos abriga o maior complexo portuário da América Latina e, no mesmo território, um dos sistemas estuarinos mais pressionados do litoral brasileiro. É nesse contexto que o Sistema Estuarino de Santos–São Vicente acumula microplásticos e contaminantes associados, com efeitos sobre os ecossistemas costeiros, a atividade pesqueira e as comunidades mais vulneráveis. Poucos lugares no país reúnem, de forma tão concentrada, o problema e a capacidade científica para enfrentá-lo.

O 1º Simpósio Internacional de Microplásticos em Ecossistemas Aquáticos (SIMPEA) nasceu dessa convergência. Realizado de 9 a 13 de junho de 2026 na Universidade Santa Cecília (UNISANTA), Santos (SP), com visita técnica ao IPEN/CNEN, em São Paulo, e saída de campo em uma praia de Santos. O evento foi o primeiro simpósio internacional brasileiro inteiramente dedicado à contaminação de ambientes aquáticos por micro e nanoplásticos, com o 1º Workshop de Coleta, Caracterização e Aplicações Nucleares para Mitigação de Microplásticos (NuclearMicro) integrando a programação.

A mesa de abertura traduziu essa intenção de articulação entre ciência, gestão pública e sociedade civil, reunindo Silvia Ângela Teixeira Penteado (Reitora da UNISANTA); Fábio Giordano (Pró-Reitor Acadêmico da UNISANTA); Camilo Dias Seabra Pereira (UNISANTA); Niklaus Ursus Wetter (Diretor de Pesquisa do IPEN/CNEN); William Rodriguez Schepis (Diretor-Presidente do Instituto EcoFaxina); Claudia Condé Lamparelli (Gerente do Setor de Águas Litorâneas da CETESB); Luciano Leonardo Guimarães Rocha (Capitão de Fragata, Marinha do Brasil); Cleiton Jordão Santos (Secretário de Meio Ambiente de Cubatão); Gabriel Micelli (Secretário Adjunto de Meio Ambiente de Santos).

A participação

O 1º SIMPEA reuniu 182 participantes ao longo de 5 dias de programação e 27 horas de conteúdo. Desse total, 158 corresponderam a inscritos – 98 na modalidade presencial, 58 na modalidade on-line e 2 em participação híbrida –, aos quais se somaram palestrantes e convidados institucionais. O público veio de 14 estados brasileiros (Amazonas, Bahia, Espírito Santo, Goiás, Maranhão, Mato Grosso, Minas Gerais, Paraíba, Paraná, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina e São Paulo), além de participantes do Paraguai, dos Estados Unidos e da Alemanha, totalizando 4 países representados. A composição do público confirmou o caráter formativo do evento: estudantes de graduação e de pós-graduação, docentes, pesquisadores, gestores públicos e profissionais dos setores de saneamento, meio ambiente, indústria e portos.

Os trabalhos científicos

A chamada de trabalhos recebeu 22 submissões, todas na forma de resumos em língua inglesa, conforme as Normas para Submissão de Resumos do evento. Após avaliação pela comissão científica, 22 resumos foram aprovados, o que corresponde a uma taxa de aceitação de 100%. São esses os trabalhos reunidos neste volume, apresentados em ordem alfabética por título e acompanhados da sessão de pôsteres realizada no terceiro dia de programação.

O conjunto aprovado tem origem em 23 instituições distintas – IPEN/CNEN, UNESP, UNISANTA, UNIFESP, UERJ, UFF, UFPR, UDESC, UEM, UFG, UFT, UFTM, UFSCar, UFRGS, IFSC, UNESC, Instituto de Pesca/APTA, Universidade de Vassouras, CESMAC, Instituto EcoFaxina, Università degli Studi di Cagliari (Itália), Northeastern University (Estados Unidos) e Universidad Central de Venezuela –, o que dá a medida da capilaridade nacional e internacional alcançada por uma primeira edição. Tematicamente, os 22 resumos cobrem a ocorrência e o monitoramento de microplásticos em praias, rios, sedimentos, água tratada e material particulado atmosférico; os efeitos ecotoxicológicos em anêmonas, ostras, crustáceos, peixes e corais; o desenvolvimento e a harmonização de métodos analíticos, incluindo ensaios interlaboratoriais e técnicas nucleares; tecnologias de remoção e materiais alternativos; e, por fim, governança e educação ambiental.

A programação científica

A programação compreendeu 22 palestras, ministradas por 21 especialistas de 11 instituições nacionais e internacionais de referência (IPEN/CNEN, CETESB, UNIFESP, UNISANTA, HTW Dresden (Alemanha), UFSCar, UFPA, UFES, UNESP, SEMIL e Instituto Butantan), e 6 oficinas práticas. Organizou-se em três eixos temáticos, desenvolvidos em dias consecutivos na UNISANTA, seguidos das atividades laboratoriais e de campo do Workshop NuclearMicro. Registra-se a seguir a programação integral, na ordem em que foi apresentada.

Eixo Poluição das Águas – 9 de junho

"Quem Decide o Enfrentamento Contra a Poluição Plástica?", por Walter Waldman (UFSCar).
"Microplásticos nos Ambientes Costeiros: Desafios e Caminhos para o Monitoramento", por Claudia Condé Lamparelli (CETESB).
"O Que Acontece em Santos, Fica na Praia de Santos: Plásticos e Drogas Ilícitas em Ecossistemas Marinhos", por Camilo Dias Seabra Pereira (UNISANTA).
"Microfibras: O Impacto Invisível da Moda no Oceano", por Paloma Kachel Gusso Choueri (UNISANTA).
"O Que os Olhos Não Veem, o Oceano Sente: Microplásticos em Ambientes Marinhos", por Caio Rodrigues Nobre (UNISANTA).
"Microplásticos no Ambiente Marinho: Da Poluição Global aos Impactos nos Organismos Bentônicos", por Daphine Ramiro Herrera (UNESP).
"Poluição por Plástico nos Rios Elba e Vjosa: Resultados do Monitoramento de Macro e Microplásticos", por Kathrin Harre (HTW Dresden, Alemanha).
"Microplásticos em Ecossistemas Costeiros no Espírito Santo: O que os Invertebrados nos Contam?", por Mércia Barcellos da Costa (UFES).

Eixo Técnicas Analíticas: Padronização e Harmonização – 10 de junho

"Amostragem Ambiental e Microplásticos: Desafios para a Confiabilidade dos Dados Ambientais", por Renan Lourenço Oliveira Silva (CETESB).
"Poluição Plástica na Amazônia: Cenário Atual e Perspectivas", por José Eduardo Martinelli Filho (UFPA).
"Efeitos Biológicos de Microplásticos e Microfibras no Ambiente Aquático", por Sueli Ivone Borrely (IPEN/CNEN).
"Micro e Nanoplásticos em Meios Complexos: Detecção Ótica Ultrassensível, Transporte e Efeitos em Ecossistemas Tropicais", por Niklaus Ursus Wetter (IPEN/CNEN).
"Microplásticos em Tempos de Harmonização", por Décio Semensatto Jr. (UNIFESP).
"De Macroplásticos a Microplásticos: Modelagem de Processos de Fragmentação e Abrasão em Sistemas Fluviais Usando LAVA e Medições Experimentais de Desgaste", por Lucas Kurzweg (HTW Dresden, Alemanha).

Eixo Governança e Educação – 11 de junho

"Programas de Monitoramento Ambiental do IPEN e suas Atividades Relacionadas aos Compostos Orgânicos e Microplásticos", por Lucilena Rebelo Monteiro (IPEN/CNEN).
"Regulamentação Jurídica da Utilização dos Pellets de Plástico na Limpeza de Embarcações", por Maria Cristina Gontijo (Maritime Law Academy).
"Microplásticos e o Papel do Terceiro Setor: Ciência Cidadã, Pesquisa e Monitoramento, como Fundamentos para a Elaboração de Projetos de Combate ao Lixo no Mar", por William Rodriguez Schepis (Instituto EcoFaxina).
"O Plano Estadual de Combate ao Lixo no Mar", por Vitória Scrich (SEMIL).
"Importância do Protocolo de Análise: Comparação Interlaboratorial de Análise de Padrão Internacional", por Duclerc Fernandes Parra (IPEN/CNEN).
"Caminhos da Governança: do Laboratório ao Tratado Global dos Plásticos", por Ítalo Braga de Castro (UNIFESP).
"Microplásticos: Quando a Ciência de Polímeros Encontra as Ciências Ambientais", por Walter Waldman (UFSCar).
"Ecossistemas Aquáticos: o Papel da Pesquisa e Divulgação Científica no Instituto Butantan", por Lenita de Freitas Tallarico (Instituto Butantan).

Oficinas realizadas na UNISANTA – 10 de junho

"Calorimetria Exploratória Diferencial (DSC) como uma Técnica Robusta e Econômica para Identificar e Quantificar Microplásticos em Amostras Ambientais", por Kathrin Harre, com apoio de Lucas Kurzweg (HTW Dresden, Alemanha).
"Plásticos e Ecotoxicologia Marinha", por Camilo Dias Seabra Pereira (UNISANTA).

Workshop NuclearMmicro – visita técnica ao IPEN/CNEN, 12 de junho

"Identificação de Microplásticos e Discussão sobre a Influência do Envelhecimento na Identificação de Partículas", por Duclerc Fernandes Parra (IPEN/CNEN).
"Processamento de Efluentes por Radiação", por Samir Luiz Somessari (IPEN/CNEN).
"Controle de Qualidade e Potabilidade de Águas Conforme a Portaria GM/MS nº 888/2021", por Lucilena Rebelo Monteiro (IPEN/CNEN).
"Ecotoxicologia Aplicada aos Efeitos de Microplásticos em Organismos Aquáticos", por Sueli Ivone Borrely e Murilo Álison Vigilato Rodrigues (IPEN/CNEN).

Mesa-redonda de encerramento – 11 de junho

"Microplásticos em Ecossistemas Aquáticos", com a participação de Ítalo Braga de Castro (UNIFESP), Lenita de Freitas Tallarico (Instituto Butantan), William Rodriguez Schepis (Instituto EcoFaxina), José Eduardo Martinelli Filho (UFPA) e Fábio Giordano (Pró-Reitor Acadêmico da UNISANTA), sob mediação de Camilo Dias Seabra Pereira (UNISANTA).

O quinto dia foi dedicado à saída de campo em Santos, conduzida pelo Instituto EcoFaxina, com coleta e caracterização gravimétrica de resíduos em atividade de ciência cidadã – encerramento coerente com a proposta do simpósio de aproximar o laboratório do território.

Agradecimentos

A comissão organizadora agradece, em primeiro lugar, aos autores que submeteram seus trabalhos e aos 21 palestrantes e ministrantes de oficinas que aceitaram o convite para a primeira edição de um evento ainda sem histórico – uma adesão que sustentou o nível técnico aqui registrado. Agradece às instituições realizadoras, Instituto EcoFaxina e IPEN/CNEN, e à Universidade Santa Cecília (UNISANTA), pela estrutura e pela equipe colocados à disposição.

Agradece às agências e organismos de fomento que financiaram as pesquisas reunidas neste volume – IAEA, CNPq, FAPESP, CAPES e FAPESC –, conforme declarado pelos próprios autores em seus resumos, e aos veículos de comunicação que deram repercussão ao evento (Portal GOV.BR, IPEN FM, Jornal A Tribuna, TV Tribuna, Jornal BoqNews, Juicy Santos, Portal Unisanta, Santa Portal, Mussicom, Jornal da Orla, Lecotox e Instituto EcoFaxina). Agradece, por fim, aos participantes, cuja presença qualificada em auditório e nas plataformas on-line converteu a programação em debate efetivo.

Que a leitura destes Anais sirva ao propósito que reuniu as instituições realizadoras: transformar evidência científica em política pública e em ação concreta de combate à poluição por plásticos em ecossistemas aquáticos.

Comissão Organizadora do 1º SIMPEA

FOREWORD

Santos hosts the largest port complex in Latin America and, in the same territory, one of the most heavily pressured estuarine systems on the Brazilian coast. The Santos–São Vicente Estuarine System accumulates microplastics and associated contaminants, with effects on coastal ecosystems, fisheries and the most vulnerable communities. Few places in Brazil combine the problem and the scientific capacity to address it in such concentrated form.

The 1st International Symposium on Microplastics in Aquatic Ecosystems (SIMPEA) was born from this convergence. Held from June 9th to 13th, 2026 at the Santa Cecília University (UNISANTA), Santos (SP), with a technical visit to IPEN/CNEN, in São Paulo, and a field trip to a beach in Santos. The event was the first Brazilian international symposium entirely dedicated to the contamination of aquatic environments by micro and nanoplastics, with the 1st Workshop on Collection, Characterization and Nuclear Applications for Microplastic Mitigation (NuclearMicro) integrated into the program.

The opening session reflected that intent to bring together science, public management and civil society, with Silvia Ângela Teixeira Penteado (Rector of UNISANTA); Fábio Giordano (Academic Pro-Rector of UNISANTA); Camilo Dias Seabra Pereira (UNIFESP/UNISANTA researcher); Niklaus Ursus Wetter (Director of Research, IPEN/CNEN); William Rodriguez Schepis (President-Director of Instituto EcoFaxina); Claudia Condé Lamparelli (Head of the Coastal Waters Sector, CETESB); Luciano Leonardo Guimarães Rocha (Frigate Captain, Brazilian Navy); Cleiton Jordão Santos (Secretary for the Environment, Cubatão); Gabriel Micelli (Deputy Secretary for the Environment, Santos).

Participation

The 1st SIMPEA brought together 182 participants over 5 days of programme content and 27 hours of sessions. Of that total, 158 were registered attendees – 98 on site, 58 online and 2 in hybrid mode – joined by speakers and institutional guests. The audience came from 14 Brazilian states (Amazonas, Bahia, Espírito Santo, Goiás, Maranhão, Mato Grosso, Minas Gerais, Paraíba, Paraná, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina and São Paulo), together with participants from Paraguay, the United States and Germany, for a total of 4 countries represented. Its composition confirmed the formative character of the event: undergraduate and graduate students, lecturers, researchers, public managers and professionals from the sanitation, environmental, industrial and port sectors.

Scientific contributions

The call for papers received 22 submissions, all as abstracts in English, in accordance with the event's Guidelines for Submitting Abstracts. Following review by the scientific committee, 22 abstracts were approved – an acceptance rate of 100%. These are the contributions gathered in this volume, arranged alphabetically by title and accompanied by the poster session held on the third day of the programme.

The approved set originates from 23 distinct institutions – IPEN/CNEN, UNESP, UNISANTA, UNIFESP, UERJ, UFF, UFPR, UDESC, UEM, UFG, UFT, UFTM, UFSCar, UFRGS, IFSC, UNESC, Instituto de Pesca/APTA, Universidade de Vassouras, CESMAC, Instituto EcoFaxina, Università degli Studi di Cagliari (Italy), Northeastern University (United States) and Universidad Central de Venezuela –, which gives the measure of the national and international reach achieved by a first edition. Thematically, the 22 abstracts cover the occurrence and monitoring of microplastics on beaches, in rivers, sediments, treated water and atmospheric particulate matter; ecotoxicological effects on sea anemones, oysters, crustaceans, fish and corals; the development and harmonisation of analytical methods, including interlaboratory testing and nuclear techniques; removal technologies and alternative materials; and, finally, governance and environmental education.

Scientific programme

The programme comprised 22 lectures, delivered by 21 specialists from 11 leading national and international institutions (IPEN/CNEN, CETESB, UNIFESP, UNISANTA, HTW Dresden (Germany), UFSCar, UFPA, UFES, UNESP, SEMIL and Instituto Butantan), and 6 hands-on workshops. It was organised in three thematic axes developed on consecutive days at UNISANTA – Water Pollution (9 June); Analytical Techniques: Standardisation and Harmonisation (10 June); and Governance and Education (11 June) – followed by the laboratory and field activities of the NuclearMicro Workshop.

Two workshops were held at UNISANTA on 10 June and four at the IPEN/CNEN laboratories on 12 June. The third day closed with the round table “Microplásticos em Ecossistemas Aquáticos” (Microplastics in Aquatic Ecosystems), with Ítalo Braga de Castro (UNIFESP), Lenita de Freitas Tallarico (Instituto Butantan), William Rodriguez Schepis (Instituto EcoFaxina), José Eduardo Martinelli Filho (UFPA) and Fábio Giordano (Academic Vice-Rector of UNISANTA), moderated by Camilo Dias Seabra Pereira (UNISANTA). The fifth day was devoted to the field activity in Santos, led by Instituto EcoFaxina, with collection and gravimetric characterisation of waste as a citizen-science exercise – a closing consistent with the symposium's aim of bringing the laboratory closer to the territory.

Every lecture and workshop, with its full title, speaker and institution, is listed in the Portuguese Apresentação above; the titles are reproduced in the language in which they were delivered.

Acknowledgements

The organising committee thanks, first of all, the authors who submitted their work and the 21 speakers and workshop instructors who accepted an invitation to a first edition with no track record, a commitment that underpinned the technical level recorded here. It thanks the organising institutions, Instituto EcoFaxina and IPEN/CNEN, and UNISANTA, for the facilities, the teams and the laboratories made available.

It thanks the funding agencies and organisations that supported the research gathered in this volume – IAEA, CNPq, FAPESP, CAPES and FAPESC –, as declared by the authors themselves in their abstracts, and the media outlets that gave the event visibility (Portal GOV.BR, IPEN FM, Jornal A Tribuna, TV Tribuna, Jornal BoqNews, Juicy Santos, Portal Unisanta, Santa Portal, Mussicom, Jornal da Orla, Lecotox and Instituto EcoFaxina). Finally, it thanks the participants, whose informed presence in the auditorium and on the online platforms turned the programme into genuine debate.

May the reading of these Proceedings serve the purpose that brought the organising institutions together: turning scientific evidence into public policy and into concrete action against plastic pollution in aquatic ecosystems.

Organising Committee of the 1st SIMPEA

SUMÁRIO / CONTENTS

01. ASSESSMENT OF EMERGING ENVIRONMENTAL CONTAMINANTS IN THE SANTA ROSA STREAM, ITURAMA-MG: IDENTIFICATION AND CHARACTERIZATION OF MICROPLASTICS – *Oliveira et al.* 8

02. BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF MICROPLASTIC EXPOSURE ON THREE SEA ANEMONE SPECIES – *Borges et al.* 9

03. COLLECTION, QUANTIFICATION AND CHARACTERIZATION OF MICROPLASTICS OBTAINED FROM SANTOS BEACHES IN 2025 – *Ravaneli et al.* 10

04. COMPARATIVE STUDY ON THE PRESENCE OF MICROPLASTICS AT SANTOS BEACHES – *Ravaneli et al.* 11

05. DO IBUPROFEN-ASSOCIATED MICROFIBERS ALTER BIOLOGICAL RESPONSES IN THE DIGESTIVE GLAND OF OYSTERS? AN INTEGRATED ECOTOXICOLOGICAL APPROACH – *Santos et al.* 12

06. ENVIRONMENTAL EDUCATION AS A STRATEGY FOR MITIGATING MICROPLASTIC POLLUTION – *Martins* 13

07. EVIDENCE OF EXPOSURE OF CALLINECTES ORNATUS TO ANTHROPOGENIC PARTICLES IN SANTOS BAY, BRAZIL – *Novelli et al.* 14

08. GLOBAL MICROPLASTIC CONTAMINATION INDEXED: BIVALVES AS SENTINELS – *Ribeiro et al.* 15

09. IPEN ENVIRONMENTAL MONITORING PROGRAM ADVANCES AND PRELIMINARY METHODOLOGICAL STUDIES FOR MICROPLASTICS – *Monteiro et al.* 16

10. MICROPLASTICS AS METALS ABSORBERS - IDENTIFICATION BY NEUTRON ACTIVATION ANALYSIS (NAA) – *Parra et al.* 17

11. MICROPLASTICS IN FRESHWATER FISH FROM BRAZIL: PATTERNS AND GAPS – *Esteves* 18

12. MICROPLASTICS INTERLABORATORY TEST: COMPARISON OF INTERNATIONAL CAPABILITIES – *Ravaneli et al.* 19

13. NASCENTECH: BIOSENSOR DEVELOPMENT FOR MICROPLASTIC DETECTION IN WATER RESOURCES – *Leiroz et al.* 20

14. OCCURRENCE AND REMOVAL OF SUSPECTED MICROPLASTICS IN CONVENTIONAL DRINKING WATER TREATMENT PLANTS – *Lima et al.* 21

15. OCCURRENCE OF MICROPLASTICS IN THREE SANDY BEACHES OF SOUTHERN SANTA CATARINA, BRAZIL – *Benincá et al.* 22

16. PHOTODEGRADATION OF PVC MICROPLASTICS: CHEMICAL AND MORPHOLOGICAL CHARACTERIZATION BY FTIR SPECTROSCOPY AND SCANNING ELECTRON MICROSCOPY – *Santana et al.* 23

17. PHOTOELECTROCATALYTIC REMOVAL OF POLYETHYLENE MICROPLASTICS USING TiO2 NANOTUBE PHOTOELECTRODES IN A RECIRCULATING SYSTEM: CURRENT DENSITY EFFECT ON PERFORMANCE AND ENERGY DEMAND – *Mello et al.* 24

18. POLYPROPYLENE AND POLYETHYLENE PARTICLE SIZE AFTER DISSOLUTION AND NANOPRECIPITATION – *Borsari et al.* 25

19. PVP NANOGELS AND BIODEGRADABLE FILMS FOR AGRICULTURAL APPLICATIONS: A LITERATURE REVIEW – *Cardoso et al.* 26

20. RELATIONSHIP BETWEEN BIOLOGICAL PARAMETERS AND ANTHROPOGENIC PARTICLE INGESTION IN LAGOCEPHALUS LAEVIGATUS FROM THE SOUTHEAST-SOUTHERN BRAZILIAN CONTINENTAL SHELF – *Andrade et al.* 27

21. SEASONAL VARIATION OF MICROPLASTICS IN THE PARANÁ RIVER WATER COLUMN, BRAZIL – *Almeida et al.* 28

22. TEMPORAL RECORD OF MICROPLASTIC INCORPORATION IN CORAL FROM THE ABROLHOS CORAL COMPLEX, BRAZIL – *Rocha et al.* 29

ASSESSMENT OF EMERGING ENVIRONMENTAL CONTAMINANTS IN THE SANTA ROSA STREAM, ITURAMA-MG: IDENTIFICATION AND CHARACTERIZATION OF MICROPLASTICS

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Introduction: Due to their low cost and high durability, plastics are widely used in several sectors of society [1]. However, because of their improper disposal, they have become dispersed throughout aquatic ecosystems, turning into contaminants widely distributed in the environment [2]. Plastic particles smaller than 5 mm are called microplastics and have attracted significant scientific interest due to their massive circulation. In Iturama, Minas Gerais, the Santa Rosa Stream is strongly affected by anthropogenic activities, mainly due to the improper disposal of solid waste and effluents [3]. The aim of this study was to investigate the presence and characterize the polymers found as microplastics in the waters of this stream. **Methodology:** Two sampling points were selected in the Santa Rosa Stream, the first located downstream from the Sewage Treatment Plant and the second at the mouth of the watercourse. At both locations, approximately 300 liters of stream water were collected using 20-liter containers. Subsequently, sieving was carried out to separate the solid and liquid phases of the water using three stacked sieves with the following mesh sizes, from top to bottom: 1 mm, 210 µm and 53 µm. The material retained in each sieve was separated and taken to the laboratory; this procedure was performed at both sampling points. In the laboratory, the samples were subjected to oxidative digestion of organic matter using the Fenton reaction. Afterwards, density separation was performed using a saturated sodium chloride solution [4]. The isolated/agglomerated particles were filtered through cellulose ester membranes and analyzed by microscopy and spectroscopy to identify the constituent polymers. **Results and Discussion:** The analyses revealed bands compatible with Nylon 6,6 [5] and Polyethylene Terephthalate (PET), confirming the presence of synthetic polymers in the analyzed samples. **Conclusion:** This study contributed to expanding the knowledge about the watercourse and confirmed the suspected presence of microplastics in the Santa Rosa Stream watershed. The presence of Nylon 6,6 and PET reinforces the need for further studies to broaden the understanding of the extent of this contamination and to investigate the behavior of microplastics in this watercourse, as well as to clarify the sources of this contamination in order to combat it and seek solutions to this problem, which is intensifying every day both regionally and worldwide.

Keywords: Microplastics; Santa Rosa Stream; Emerging Contaminants; Water Pollution

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BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF MICROPLASTIC EXPOSURE ON THREE SEA ANEMONE SPECIES

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Introduction: Microplastic (MP) pollution in marine ecosystems threatens biodiversity due to its bioavailability across multiple trophic levels, causing impacts already documented in commercially important species [1–4]. However, the effects on non-commercial organisms, such as sea anemones (Actiniaria), remain poorly understood [5]. Therefore, this study investigated the physiological and behavioral effects caused by MP ingestion in Anemonia sargassensis, Bunodosoma caissarum and Actinia bermudensis. **Methodology:** A total of 16 individuals were used, including 8 A. bermudensis and 4 A. sargassensis collected in Ubatuba (SP), and 4 B. caissarum collected in Guarujá (SP). Among the A. bermudensis individuals, half were acclimated in the laboratory for 10 months and the other half were recently acclimated. The samples were transferred to LEDALab, in Bauru (SP), where they were maintained in individual aquariums under controlled conditions for one month. In each group, one individual was used as a control and was not exposed to MPs. The remaining individuals were subjected to the ingestion of five plastic particles, and this procedure was repeated five times. All specimens from each group were weighed and measured at the beginning and end of each experiment. Timelapse images were used to analyze MP ingestion, retention and egestion times, as well as to observe the behavioral responses of the sea anemones. **Results and Discussion:** Recently acclimated A. bermudensis showed resistance to MPs, with no mortality observed, whereas acclimated individuals exhibited higher sensitivity and mortality in all experimental samples, suggesting adaptive impairment associated with long-term maintenance under controlled conditions. B. caissarum showed a progressive reduction in MP retention and egestion times, indicating adaptation to repeated exposure. A. sargassensis exhibited a progressive increase in ingestion time until complete MP rejection occurred, suggesting particle recognition. All species showed intense mucus production, body mass loss and pedal disc retraction, evidencing physiological stress caused by continuous MP exposure. **Conclusion:** Continuous MP exposure promoted physiological and behavioral alterations in all analyzed species, compromising biological fitness and highlighting the potential of sea anemones as bioindicators of marine microplastic pollution.

Funding Source: PIBIC/CNPq

Keywords: Actiniaria; Marine pollution; Microplastic

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COLLECTION, QUANTIFICATION AND CHARACTERIZATION OF MICROPLASTICS OBTAINED FROM SANTOS BEACHES IN 2025

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Introduction: After years of analyzing microplastic content in liquid and sediment samples using an in-house method, the Polymer Laboratory at the Chemistry and Environmental Center of IPEN partnered with the IAEA's NUTEC project to develop a universal evaluation protocol applicable to laboratories worldwide, aiming to generate more comparable and accurate data. The Operational Protocol for the Collection, Identification and Counting of Microplastics in Beach Sand was designed by the IAEA to meet diverse laboratory needs in terms of instrumentation, supplies and procedures adaptable to different sand matrices and similar to NOAA procedure [1]. **Methodology:** To test the protocol, 15 kg of sand samples were collected from Santos's beaches (Boqueirão, Ponta da Praia and José Menino) in the summer of 2025. Characterization was performed using existing equipment, including a Bruker Eco-ATR IR FTIR-ATR spectrophotometer and a Bruker Invenio S. **Results and Discussion:** A total of 89 particles were identified, with polyethylene, polypropylene and polystyrene being the most prevalent. PMMA, PET and PA were also detected. The mean concentration was approximately 16.5 microplastics per kilogram of sediment. The highest concentration was found at Ponta da Praia, the beach closest to the polluted estuary, while the lowest was observed at José Menino, the furthest from the estuary. Although the protocol proved adequate for its intended purpose, challenges remain in interpreting IR spectra of severely oxidized samples, particularly when using lower-sensitivity equipment such as the Eco-ATR. **Conclusion:** The difference observed between the collections in summer periods demonstrated more pollution on the beach near the estuarine channel.

Funding Source: IAEA (Projects BRA7015, BRA2019), CNPq, FAPESP.

Keywords: microplastics; FTIR-ATR; sand sediments; marine pollution

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COMPARATIVE STUDY ON THE PRESENCE OF MICROPLASTICS AT SANTOS BEACHES

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Introduction: The Polymer Laboratory at the Chemistry and Environmental Center of IPEN evaluated sediments collected in 2023 and 2025 from three different beaches (Boqueirão, José Menino and Ponta da Praia) located in the city of Santos, on the Brazilian coast, regarding the evolution of their microplastic content over the years. Do the public state cleaning initiatives contribute to minor beach pollution? [1,2] **Methodology:** The samples were collected, dried, separated and FTIR-ATR characterized roughly following the same procedure in both sampling years. **Results and Discussion:** The results reveal an extensive decrease in mean concentration considering all beaches, with about five times fewer MPs in 2025 than in 2023. Additionally, two out of the three beaches, José Menino and Boqueirão, showed a reduction in their specific concentration, Boqueirão being the most drastic with a decay of ten times the concentration of the previous year and José Menino with about three times. Interestingly, however, Ponta da Praia presented a 1.6-fold increase in concentration, and several more different types of polymers were detected in comparison with the 2023 collection. Both observations could be attributed to the different collection times (July versus October), to some sort of isolated disposal event that caused a potentially false negative effect on the results, or to the fact that this beach is the closest to the estuary, where residues mostly accumulate. **Conclusion:** The comparison study provided important insights into the microplastic content of Santos's beaches including revealing overall decay over the course of 2 years of investigation, isolated decay on José Menino and Boqueirão, possibly due to the implementation of public state cleaning initiatives, but increase on Ponta da Praia, leading to hypothesis on the cause of this exceptional event, such as the occurrence of a massive disposal or accident near the time of collection.

Funding Source: IAEA (Projects BRA7015, BRA2019), CNPq, FAPESP.

Keywords: Microplastics; Santos's city; characterization; marine pollution; environmental chemistry

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DO IBUPROFEN-ASSOCIATED MICROFIBERS ALTER BIOLOGICAL RESPONSES IN THE DIGESTIVE GLAND OF OYSTERS? AN INTEGRATED ECOTOXICOLOGICAL APPROACH

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Introduction: Population growth, higher healthcare demand and the limited efficiency of traditional sewage treatment increase the presence of pharmaceutical compounds in aquatic environments [1]. Microplastics are emerging contaminants that serve as carriers, facilitating the transport, concentration and redistribution of potentially toxic substances across environmental compartments and enhancing their bioavailability to aquatic organisms [2]; fibers are the most frequently found format [3]. This study evaluated the ecotoxicological effects of ibuprofen associated with microfibers in the oyster Crassostrea gasar, combining biochemical biomarkers, histopathological analyses and microfiber accumulation. **Methodology:** Adult C. gasar were exposed under controlled laboratory conditions to seven treatments: Control, DMSO, polyester (POLY), ibuprofen (IBU), aged polyester (PE), polyester adsorbed with ibuprofen (PU) and aged polyester adsorbed with ibuprofen (PEU). After exposure, digestive gland tissues were collected for biochemical and histopathological analyses and hemolymph for the neutral red retention time (NRRT) assay. Lipid peroxidation (LPO), DNA damage and NRRT were evaluated to assess cellular damage [4,5]. Histological sections followed routine procedures, and tissue alterations including digestive tubule atrophy and general histopathological damage were analyzed under light microscopy [6]. For microfiber quantification, gills, digestive glands and remaining tissues were dissected and digested with 10% KOH prior to identification and counting. **Results and Discussion:** No significant differences were found in LPO or DNA damage among treatments in the digestive glands. NRRT, however, differed significantly (Kruskal–Wallis test, $\chi^2 = 29.77$, df = 6, $p < 0.001$): Dunn's post hoc test showed significantly lower NRRT in PEU than in Control ($p = 0.0048$) and DMSO ($p = 0.0005$), and PE ($p = 0.0149$) and PU ($p = 0.0377$) were also lower than DMSO; no differences appeared among the remaining treatments. Histology revealed structural alterations in the digestive gland, including digestive tubule atrophy and tissue disorganization (Kruskal–Wallis test, $p < 0.001$). Microfiber accumulation was greater in exposed groups than in Control and DMSO, with the highest retention in the digestive gland; POLY accumulated most, especially in the digestive gland, followed by PU and PEU in the gills and remaining tissues. As filter feeders, oysters are continuously exposed to suspended particles [7], and the digestive gland is a major site for particle processing, digestion, absorption, detoxification and contaminant accumulation, so microfiber retention there may impair digestive efficiency by disrupting tubule architecture, reducing the absorptive surface area and compromising nutrient assimilation [8]. The reduced NRRT in PE, PU and especially PEU indicates that fiber aging and ibuprofen adsorption both contribute to early lysosomal destabilization even without detectable oxidative or genotoxic damage, showing the sensitivity of NRRT for detecting sublethal alterations. **Conclusion:** Pharmaceutical compounds associated with microfibers can promote cellular dysfunction, tissue damage and microfiber accumulation in the digestive gland of C. gasar. Cellular and tissue-level responses proved more sensitive indicators of exposure than LPO and DNA damage under the conditions evaluated, reinforcing the ecological risks of interactions among emerging contaminants in aquatic environments.

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Keywords: Biomarkers; Polyester microfibers; Ibuprofen; Histopathology; Digestive gland

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ENVIRONMENTAL EDUCATION AS A STRATEGY FOR MITIGATING MICROPLASTIC POLLUTION

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Introduction: The increasing presence of microplastics in aquatic ecosystems has become one of the major contemporary environmental concerns due to their impacts on biodiversity, water quality and human health. These particles, generally ranging from 1 μm to 5 mm, originate from the degradation of plastic waste improperly discarded into the environment, as well as from industrial and domestic products. In aquatic environments, microplastics can be ingested by organisms from different trophic levels, compromising food chains and essential ecological processes. Environmental education emerges as an important strategy for social awareness and pollution prevention, promoting behavioral changes related to the consumption, disposal and reuse of plastic materials. The present study aimed to analyze the contribution of environmental education in mitigating microplastic pollution in aquatic ecosystems, highlighting educational practices focused on community awareness and the promotion of sustainability. **Methodology:** The methodology used consisted of an integrative literature review, developed through chronologically organized stages. Initially, the research theme and objectives were defined. Subsequently, scientific articles were searched in the Google Scholar, SciELO, ScienceDirect and PubMed databases using descriptors such as "microplastics", "environmental education", "aquatic ecosystems" and "water pollution". Articles published between 2018 and 2025, in Portuguese and English, related to environmental education and the mitigation of plastic pollution were included. After applying the inclusion and exclusion criteria, the 9 selected studies were qualitatively analyzed, considering aspects such as educational methodologies, community participation and results obtained from environmental actions. **Results and Discussion:** The results demonstrated that environmental education programs significantly contribute to reducing plastic waste pollution in aquatic environments. Several studies reported an increase in environmental awareness among students, riverside communities and urban populations after educational campaigns, workshops, lectures and practical activities involving river and beach cleanups. Continuous educational actions were shown to encourage behavioral changes, such as reducing the use of disposable plastics, promoting recycling practices and improving the proper disposal of solid waste. Community participation proved to be fundamental for strengthening environmental actions, expanding social engagement and collective awareness regarding the impacts of microplastics on aquatic ecosystems. However, the studies pointed out limitations related to the lack of effective public policies, insufficient environmental monitoring and difficulties in maintaining the continuity of educational projects in some regions. **Conclusion:** It was concluded that environmental education represents a strategic and effective tool for mitigating microplastic pollution, contributing to the development of critical and sustainable awareness in society. The objectives of the study were achieved, since the analysis of the selected studies demonstrated that educational practices promote relevant behavioral changes and strengthen environmental preservation actions. Therefore, it is essential to increase investments in environmental education programs integrated with public policies for solid waste management and water resource conservation, aiming to reduce the impacts caused by microplastics in aquatic ecosystems.

Keywords: Environmental education; Microplastics; Students

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EVIDENCE OF EXPOSURE OF CALLINECTES ORNATUS TO ANTHROPOGENIC PARTICLES IN SANTOS BAY, BRAZIL

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Introduction: The increasing production and widespread use of plastic materials has resulted in the accumulation of anthropogenic particles in marine ecosystems worldwide, raising concerns about their effects on aquatic organisms and ecosystem functioning. Due to their small size and persistence, these particles can be ingested by a wide range of species and transferred across trophic levels. Santos Bay, located on the southeastern coast of Brazil, is one of the country's most important coastal regions, hosting intense port, industrial, urban and fishing activities, which may contribute to particle contamination. The blue swimming crab Callinectes ornatus is a common benthic crab in the southwestern Atlantic and an ecologically relevant species that may be particularly susceptible to anthropogenic particle exposure due to its close association with bottom sediments. This study aimed to investigate the occurrence and level of exposure to anthropogenic particles in the stomachs of C. ornatus collected in Santos Bay, São Paulo State, Brazil [1]. **Methodology:** Twenty individuals were sampled at two sites using a shrimp trawler. Stomachs were digested in potassium hydroxide (KOH) at 60 °C for 48 h, followed by density separation using sodium chloride (NaCl). Recovered particles were filtered through glass fiber membranes and examined under a stereomicroscope for identification and characterization [2]. **Results and Discussion:** Anthropogenic particles were detected in 100% of the individuals analyzed. A total of 312 particles were recovered, ranging from 0.04 to 4.70 mm, with a mean size of 0.74 mm. The mean particle concentration was 0.93 particles/100 g at site 1 (10 m depth) and 0.43 particles/100 g at site 2 (14 m depth). Fibers were the predominant particle type, followed by fragments, while blue and black were the most frequent colors. The high abundance of blue fibers may reflect the influence of fishing gear and urban discharges such as domestic wastewater and textile effluents. In addition, the greater number of particles observed at the coastal site suggests the influence of local contamination sources, including port operations, industrial activities, sewage inputs and urban runoff [3]. **Conclusion:** The widespread occurrence of anthropogenic particles in C. ornatus indicates substantial exposure of this species within Santos Bay and highlights the extensive distribution of anthropogenic contaminants in this ecosystem. As the first report of anthropogenic particle ingestion in C. ornatus, this study provides important baseline information for future monitoring programs and supports the potential of this species as a biomonitor of contamination in coastal ecosystems. Further research is needed to assess the long-term ecological consequences of particle exposure and to support effective mitigation strategies in marine environments.

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Keywords: Marine debris; Coastal pollution; Decapod crustaceans; Environmental monitoring

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GLOBAL MICROPLASTIC CONTAMINATION INDEXED: BIVALVES AS SENTINELS

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Introduction: Microplastic contamination is one of the major components of the ongoing global pollution crisis, affecting biodiversity, ecosystem functioning and food safety worldwide. Despite the increasing number of studies reporting microplastic accumulation in marine organisms, global comparisons remain difficult due to the lack of standardized contamination categories. Bivalves are particularly suitable as sentinels of microplastic contamination because of their filter-feeding behavior, ecological relevance, wide geographic distribution and commercial importance for human consumption. Therefore, this study proposed the Microplastic Contamination Index (MPCI) as a standardized framework to classify worldwide contamination levels in bivalves and identify global hotspots, research gaps, and socioecological and food safety risks. **Methodology:** A global systematic review was conducted using the Scopus and Google Scholar databases [1–3]. Peer-reviewed articles published up to September 2025 reporting microplastic concentrations in bivalves were compiled. Only studies presenting concentrations in particles g-1 wet weight and including polymer identification were considered. Spatial analyses and interpolation were performed using QGIS software to identify worldwide contamination patterns. **Results and Discussion:** The final dataset included 234 articles, comprising 3,404 concentration records from 152 bivalve species collected across 49 countries between 2011 and 2024. Concentration categories were established through percentile distribution of the global dataset, resulting in six classes: very low (<0.07), low (0.07–0.30), moderate (0.30–1.00), high (1.00–2.78), very high (2.78–6.18) and severe (>6.18 particles g-1). Aquaculture farms and protected areas were used as study cases to evaluate food safety and biodiversity conservation risks. Results revealed pronounced spatial variability in global contamination levels. Severe contamination occurred in 23 countries, especially in South America and Asia, with the highest concentrations observed in Argentina, Brazil, China, Indonesia and India. Aquaculture farms from 13 countries presented very high or severe contamination, indicating potential risks for food safety and chronic human exposure through seafood consumption. Protected areas also showed substantial contamination, including severe levels within conservation units from Europe, Asia and Latin America, demonstrating that protection status alone is insufficient to prevent microplastic contamination. Polyethylene, polyethylene terephthalate and cellulose were the dominant polymers worldwide, while fibers and fragments were the main shapes, blue, black and transparent the predominant colors, and particles smaller than 500 µm prevailed globally. **Conclusion:** The MPCI provides a simple and standardized tool for worldwide comparisons of microplastic contamination levels in bivalves and may be extended to other environmental matrices. The results highlight the urgent need for global monitoring standardization, improved waste management and international policies to mitigate microplastic contamination in aquatic ecosystems.

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Keywords: Biomonitoring; Food; Indexing; Ingestion; Protection

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IPEN ENVIRONMENTAL MONITORING PROGRAM ADVANCES AND PRELIMINARY METHODOLOGICAL STUDIES FOR MICROPLASTICS

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Introduction: In 2022 the Nuclear and Energy Research Institute (IPEN/CNEN) established the Environmental Monitoring Plan of Atmospheric Depositions (PMDA), aligned with national and international guidelines for air quality and pollutant deposition assessment [1, 2, 3]. The PMDA builds a database of typical and critical air quality scenarios, supports spatial and temporal analyses of pollutant levels, annually updates inventoried emission data and determines deposition factors for the designated study areas, implementing an air quality tracking system within the IPEN facilities that safeguards the health of the institutional workforce and the surrounding urban population. Beyond traditional contaminants, exploratory studies have been initiated to evaluate the feasibility of monitoring emerging pollutants of global concern, specifically microplastics in atmospheric samples. Although not yet part of the official PMDA scope, these preliminary assessments aim to establish future protocols. **Methodology:** Wet and dry depositions are monitored with specialized apparatuses [4, 5]: total deposition sampler for rainwater, allowing measurement of pH and conductivity followed by filtration or solid fraction separation, and volumetric air sampling or dry deposition procedures for Total Particulate Matter (TPM). Samples then undergo solvent extraction or acid digestion for organic and elemental analysis. Consolidated protocols cover anions and cations by ion chromatography (IC), heavy metals by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), and persistent organic pollutants including polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). For microplastics, a preliminary screening protocol was developed to evaluate the effectiveness of collection, storage, and sample treatment procedures. Qualitative evaluation was conducted by UV-induced fluorescence at 362 nm combined with high-resolution smartphone imaging. This stage focused on validating a rapid, cost-effective step to detect polymer particles and fibers on glass fiber filters prior to more advanced spectroscopic analyses. **Results and Discussion:** Monitoring is carried out at the USP-IPEN monitoring station. Data from 2022 through 2025 show regular tracking of coarse particulate matter (PM10) against legal environmental thresholds [2, 3], and TPM samples have been analyzed for radionuclides, inorganic ions, heavy metals and organic compounds. The scope was recently expanded for a pilot assessment of microplastics: UV fluorescence identified distinct microplastic fragments and elongated polymer fibers on glass fiber filters collected within the IPEN campus. These preliminary findings serve to evaluate the integrity of the collected material and the efficiency of the treatment methods. Future analysis may correlate abundance and polymer composition with local anthropogenic activities, pending the potential future integration of these pollutants into the program. **Conclusion:** The PMDA demonstrates that gaseous effluent releases within the university campus remain fully compliant with current environmental legislation. Its continuous technical evolution reflects IPEN's commitment to assessing emerging contaminants. While the evaluation of microplastics is currently limited to preliminary methodological trials – focusing on collection and treatment protocols – it provides essential data for a holistic understanding of their environmental fate. Ultimately, the program continues to safeguard the health of the workforce and the surrounding population, ensuring the highest standards of socio-environmental safety.

Funding Source: CNPq (403200/2025) (Chamada Universal 44/2024).

Keywords: Atmospheric deposition; Environmental monitoring; Emerging pollutants; Microplastics; Air quality

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MICROPLASTICS AS METALS ABSORBERS - IDENTIFICATION BY NEUTRON ACTIVATION ANALYSIS (NAA)

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Introduction: In recent years, microplastic pollution has emerged as one of the biggest global environmental challenges. These particles, derived from the breakdown of larger plastics or intentionally produced on a microscopic scale, are found in aquatic, terrestrial and even atmospheric environments. Besides their persistence and ubiquity, microplastics have a concerning trait: the ability to adsorb and accumulate chemical contaminants, including heavy metals like lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As) and nickel (Ni) [1]. These elements are highly toxic and bioaccumulative and can be transferred along the food chain, posing risks to human health and biodiversity. **Methodology:** Detecting and quantifying heavy metals in microplastics requires sensitive and reliable analytical methods. Among the available techniques, Neutron Activation Analysis (NAA) stands out for its precision, non-destructive nature and ability to identify multiple elements simultaneously. NAA is based on irradiating the sample with neutrons in a nuclear reactor. This exposure induces nuclear reactions in the nuclei of the elements present, forming unstable radionuclides. These radionuclides emit characteristic gamma radiation, which can be detected and analyzed through spectrometry; each element has a specific spectrum, allowing its identification and quantification with great sensitivity. For illicit or pharmaceutical drugs, FTIR-ATR and micro-Raman spectroscopy is used to detect traces adsorbed on microplastics. Pellets of sediments collected in the Santos harbor region were analyzed [2]. **Results and Discussion:** FTIR-ATR detection of drug traces adsorbed on microplastics provided relevant information about contamination routes and potential toxicological risks. Elements identified by NAA in the pellets were: Cr, Br, Fe, Co, Zn, Cd, As, Sb. And heroin, lidocaine were identified by spectrometry. Therefore, the combined use of NAA for heavy metals and FTIR-ATR for organic compounds significantly enhances the ability to characterize microplastics as carriers of multiple pollutants. **Conclusion:** The combined use of NAA for heavy metals and ATR-FTIR for organic compounds significantly expands the characterization capabilities of microplastics as vectors of multiple pollutants.

Funding Source: IAEA (Projects BRA7015, BRA2019), CNPq, FAPESP.

Keywords: Neutron Activation Analysis; microplastic absorption; heavy metals. FTIR-ATR

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MICROPLASTICS IN FRESHWATER FISH FROM BRAZIL: PATTERNS AND GAPS

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Introduction: The importance of microplastic (MP) contamination in freshwater environments, as well as in freshwater fish used to investigate experimental questions, has been addressed over the last decade in Brazil through a variety of approaches which, however, have not yet been properly systematized in order to guide the necessary approaches and identify existing gaps. The present study aimed to carry out a systematic review on these issues, considering only studies performed in Brazil, with literature published between 1999 and April 2026. **Methodology:** We searched for scientific studies relating microplastics and fishes, using as search tools Google Scholar, SciELO, SCOPUS and ISI (WoS), with different combinations of the keywords "plastics, microplastics, freshwater, river, reservoir, aquaculture, pisciculture, fish and Brazil", searched in English, Portuguese and Spanish. Screening of titles and abstracts was performed using Rayyan software [1] for duplicate removal and inclusion evaluation, following the PRISMA Protocol [2]. **Results and Discussion:** A total of 173 published articles were initially retrieved through searches across the selected electronic databases. Following the removal of 33 duplicate records, 140 unique articles remained for screening, of which 98 did not meet the inclusion criteria. Ultimately, 42 studies met all inclusion requirements and were considered in the synthesis. The most studied region was the North of Brazil, accounting for 38.2% of the studies, followed by the South (29.41%), with the Amazon and Paraná river basins being the most frequently investigated. Studies were classified into five non-mutually exclusive thematic categories based on their objectives and the variables analyzed, such that a single study could be assigned to more than one category: (i) microplastic ingestion in freshwater fish (42.5%); (ii) influence of environmental factors and land use (32.5%); (iii) trophic ecology and feeding guilds (20%); (iv) contamination in organs and biomarkers (17.5%); and (v) experimental toxicity and physiological/reproductive effects (20%). Experimental studies accounted for 19.0%, whereas field surveys accounted for 81.0%. The most frequently studied organ was the gastrointestinal tract (58.8%), but other organs, such as the gills, liver, brain, kidneys and muscle tissue, were also investigated, accounting for 23.5% of the studies. The investigation of MP in freshwater fish in Brazil is relatively recent, with the first studies beginning in 2017; since then, there has been an increasing trend, reaching a peak of approximately 20% from 2023 onwards. The critical analysis of the set of 42 studies reveals a research field in the process of maturation, transitioning from the initial phase of mere detection to more complex investigations focusing on mechanisms of translocation, systemic toxicity and trophic dynamics. A clear trend is the shift in focus from the gastrointestinal tract (GIT) to internal organs and the use of Micro-Raman and FTIR-ATR spectroscopy as a standard for validating visual screening. However, most of the studies (55.2%) used only visual analysis of MPs, suggesting that methodological limitations and the lack of analytical standardization remain important challenges in this field. **Conclusion:** Several knowledge gaps remain regarding microplastic pollution in freshwater fish from Brazil. These include the lack of methodological standardization, the discrepancy between laboratory studies and environmental conditions, and the limited use of integrated assessments of water, sediment and biota. Other gaps relate to the limited attention given to aquaculture activities, which are known to constitute significant sources of microplastic inputs into aquatic environments. In addition, the long-term effects of chronic microplastic exposure on the reproduction, recruitment and survival of native species remain largely unknown.

Keywords: Aquatic pollution; Microplastic ingestion; Trophic transfer; Systematic review

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MICROPLASTICS INTERLABORATORY TEST: COMPARISON OF INTERNATIONAL CAPABILITIES

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Introduction: Microplastics (MPs) have emerged as a significant class of contaminants due to their widespread presence in various environmental compartments. The ingestion of these particles poses a risk to both human health and the local biota. Specific protocols for analysis are essential to ensure that researchers are speaking the same scientific language [1]. Without harmonized methodologies, results become fragmented, incomparable and ultimately less reliable [2]. **Methodology:** The present study discusses an interlaboratory test of the separation of a sediment sample and the identification of the microplastics (MP) contained in a reference sample. The test includes results from 48 different laboratories using the same protocol of analysis. **Results and Discussion:** The present interlaboratory test application provided clear evidence of the protocol need and compatible infrastructure for analysis. The follow results were obtained: Acceptable range (42–57 particles): only 9 labs were within it; Labs with perfect recovery (100%): Lab 5 and Lab 40; Severe underestimation: Lab 2 (0.22%), Lab 22 (18%), Lab 41 (40%); Severe overestimation: Lab 3 (440%), Lab 10 (364%), Lab 12 (370%); and spread is really high, with z-scores ranging from -3.33 to +11.33. **Conclusion:** These data reinforce that there was low interlaboratory reproducibility, and that the method needs stricter standardization – especially in density separation and polymer identification. By adopting identical protocols, laboratories worldwide can generate consistent data, strengthen the validity of conclusions and accelerate the development of effective mitigation strategies.

Funding Source: IAEA (Projects BRA7015, BRA2019), CNPq, FAPESP.

Keywords: harmonized methodology; z-score range; microplastic recovery

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NASCENTECH: BIOSENSOR DEVELOPMENT FOR MICROPLASTIC DETECTION IN WATER RESOURCES

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Introduction: Microplastic contamination has emerged as one of the most critical environmental and public health crises of the 21st century. Particles smaller than 5 mm have been detected in rivers, drinking water, aquatic organisms and human tissues, including blood, placenta and brain, posing significant risks to ecosystems and human health. Conventional detection methods, such as Fourier-transform infrared spectroscopy (FTIR) and Raman spectroscopy, are highly accurate but expensive, laboratory-dependent and unsuitable for field monitoring. The NascenTech project aims to develop an innovative, portable and reusable biosensor for in situ detection of microplastics in water resources, filling a critical technological gap in environmental surveillance. **Methodology:** The research methodology was structured in four stages: (1) a systematic scientific literature review using the search string ("sensor" OR "biosensor") AND "microplastic detection in water" in Google Scholar, which returned 62 results, from which 9 were selected; (2) technological prospection across three patent databases (Google Patents, Espacenet/EPO and INPI), retrieving 92 patents and selecting 12 relevant records; (3) development of the MVP (Minimum Viable Product) architecture, comprising four modules – a 3D-printed microfluidic body, a biofunctionalized sensitive layer (PEDOT:PSS, microbial EPS, hydrophobic peptides and gold nanoparticles/AuNPs), an optical-colorimetric detection module (blue LED 470 nm + RGB photodiode TCS34725) and an electronic-computational module (ESP32-S3 microcontroller with embedded AI via TensorFlow Lite); and (4) planning of the experimental phase, which will include fabrication of the sensitive layer, prototype assembly, calibration with polystyrene microspheres (1, 5 and 10 μm) and validation with real water samples (spring, river and treated water). **Results and Discussion:** The current phase yielded a technically consolidated MVP, supported by extensive scientific and technological mapping. The biosensor architecture integrates optical (colorimetry/scattering) and secondary electrochemical (electrical impedance) detection, allowing rapid readings without laboratory infrastructure. The sensitive surface exploits hydrophobic interactions and π–π stacking between aromatic rings to selectively capture the four main environmental polymers (PE, PP, PS, PET). This hybrid approach addresses the technological gap identified in the literature: while portable optical prototypes require complex configurations (collimated lasers, notch filters, CCD sensors) [1,2], NascenTech proposes a low-cost, field-deployable alternative. Detection of microplastics has been documented even in ecologically sensitive coastal areas of Brazil [3], reinforcing the urgency for rapid, accessible monitoring tools capable of operating in remote areas. **Conclusion:** The results obtained confirm the technical feasibility of NascenTech and its alignment with the state of the art in microplastic biosensors. The proposed architecture is innovative, reusable (estimated ≥30 cycles per unit) and directly applicable to water quality monitoring in springs, rivers, municipalities and sanitation agencies. The project contributes to SDG 6 (Clean Water), SDG 14 (Life Below Water) and SDG 3 (Good Health), democratizing access to microplastic detection in Brazil and enabling evidence-based environmental governance.

Keywords: Microplastics; Biosensor; Water resources; Environmental monitoring; Portable sensor

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OCCURRENCE AND REMOVAL OF SUSPECTED MICROPLASTICS IN CONVENTIONAL DRINKING WATER TREATMENT PLANTS

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Introduction: Microplastic pollution has emerged as a major global environmental issue due to its persistence in aquatic ecosystems and potential impacts on human health. Recent studies have reported the occurrence of microplastics (MPs) in surface water, groundwater, food products, and human tissues, raising concerns regarding drinking water safety [1–3]. In this context, the present study evaluated the occurrence and removal of MPs in conventional drinking water treatment plants (DWTPs) operating with complete treatment cycles in Goiânia, Brazil. **Methodology:** The study was conducted at two DWTPs, Meia Ponte and Mauro Borges, both operating with coagulation, flocculation, sedimentation, filtration, and disinfection processes. Water samples were collected during three consecutive days, including 2 L of raw water and 2 L of treated water for each sampling event. Sampling respected the hydraulic detention time of approximately four hours between raw and treated water collection. Samples were filtered through 5 µm and 0.5 µm membrane filters using a vacuum filtration system composed of a vacuum pump, Kitasato flask, and Büchner funnel. Suspected MPs were visually screened and quantified based on their morphological characteristics using a Zeiss Stemi 508 stereomicroscope, an approach consistent with the use of visual microscopy for counting, sizing, and morphological characterization of suspected MPs [4]. Polymer identity was not confirmed by spectroscopic analysis; therefore, particles were classified as suspected MPs based on their visual and morphological characteristics. **Results and Discussion:** The results demonstrated the occurrence of suspected MPs in both raw and treated water samples from the two evaluated DWTPs, indicating incomplete removal by conventional treatment processes. At the Meia Ponte DWTP, the mean concentration decreased from 182.83 MP/L in raw water to 93.17 MP/L in treated water, corresponding to a removal efficiency of 49%. In contrast, at the Mauro Borges DWTP, the mean concentration increased from 68.17 MP/L in raw water to 96.17 MP/L in treated water, corresponding to an apparent removal efficiency of −41%, indicating a 41% increase in particle concentration after treatment. The higher concentrations observed at the Meia Ponte DWTP may be associated with differences in watershed characteristics and anthropogenic influences. The persistence of MPs after treatment highlights limitations of conventional systems in removing these emerging contaminants, particularly smaller particles. The observed variability between the two DWTPs also emphasizes the importance of continued monitoring and standardized analytical approaches for assessing MP occurrence in drinking water. **Conclusion:** The study revealed the occurrence and persistence of suspected MPs throughout conventional drinking water treatment processes in Goiânia, Brazil. The treatment process was associated with a 49% reduction in mean MP concentration at the Meia Ponte DWTP, whereas an apparent increase was observed at the Mauro Borges DWTP. Complete removal was not achieved at either plant. These findings emphasize the need for improved monitoring strategies and the development of alternative or complementary technologies to enhance microplastic removal efficiency and improve drinking water quality.

Keywords: Microplastics; Drinking water treatment; Emerging contaminants; Filtration; Water quality

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OCCURRENCE OF MICROPLASTICS IN THREE SANDY BEACHES OF SOUTHERN SANTA CATARINA, BRAZIL

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Introduction: The ubiquity of microplastic (MP) pollution is enhanced by the low density of these particles, which facilitates their dispersion by wind and ocean currents [1]. This study aimed to evaluate the relationship between MP occurrence on beaches in southern Santa Catarina, Brazil, and their position relative to adjacent river mouths. **Methodology:** The study area comprised the coastal zone at the mouths of the Araranguá, Urussanga and Mampituba rivers. In each region, two sampling sites were established, one north and one south of the river mouth, where three 100-m transects parallel to the shoreline were defined: upper beach line, intermediate line and swash zone [2]. The top 5 cm of sediment were collected in March 2026 and grouped into four composite samples per location. In the laboratory, the samples were oven-dried and sieved. The material retained on the 1 mm sieve was examined under a stereomicroscope, and the microplastics were quantified, measured and classified according to their color and morphotype. A subsample was analyzed using Fourier-transform infrared spectroscopy (FTIR) to identify the main polymeric composition of the particles. Only glass and metal materials were used, along with nitrile gloves and cotton lab coats; the air conditioning was turned off and white filters were placed near the processing area. **Results and Discussion:** A total of 220 MP items were identified: 83 at the Mampituba River mouth, 50 at the Araranguá River mouth and 87 at the Urussanga River mouth. As the predominant longshore drift runs from south to north [3], higher MP concentrations were expected north of the river mouths, but this occurred only at the Mampituba mouth – a permanently stabilized inlet subjected to dredging during the sampling period. South of the Araranguá and Urussanga mouths, MP abundance increased closer to the inlet, corroborating the literature [4]; conversely, north of the Mampituba and Urussanga mouths abundance increased with distance from the inlet, possibly from longshore drift and local hydrodynamic conditions. Fibers were the predominant morphotype (77.8%), consistent with their reported dominance in beach environments [5]. Since only particles larger than 1 mm were considered, the observed values were lower than in studies including smaller size fractions. FTIR revealed a predominance of polyethylene (PE) and polypropylene (PP), commonly reported in coastal environments and associated with urban and fishing activities. **Conclusion:** No consistent relationship between MP concentration and distance from river mouths could be established, despite spatial trends in some areas, so broader spatial and temporal coverage is needed. These findings reinforce the importance of continuous monitoring and methodological standardization in microplastic pollution research and coastal environmental assessment.

Funding Source: FAPESC (Call for Proposals No. 24/2025).

Keywords: Estuary; Littoral drift; Plastic; Pollution

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PHOTODEGRADATION OF PVC MICROPLASTICS: CHEMICAL AND MORPHOLOGICAL CHARACTERIZATION BY FTIR SPECTROSCOPY AND SCANNING ELECTRON MICROSCOPY

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Introduction: Poly(vinyl chloride) (PVC) microplastics (MPs) are widely distributed in freshwater and marine ecosystems. Solar and UV radiation trigger photodegradation by two concurrent mechanisms: dehydrochlorination (HCl elimination, forming conjugated polyene sequences) and photo-oxidation (incorporation of carbonyl and hydroxyl groups into the polymer backbone), both altering surface chemistry and particle morphology. Studies combining FTIR spectroscopy and SEM across multiple scales and irradiation conditions remain scarce. This work investigates the chemical and morphological changes induced in PVC MPs by natural solar and artificial UV-C radiation [1,2]. **Methodology:** PVC MPs were assigned to three groups: virgin material (PVC_V, control), natural solar radiation (PVC_S) and artificial UV-C lamp irradiation (PVC_UV). FTIR spectra (ATR mode, 4000–400 cm−1) were acquired at LAMIV (UFPR) and converted to absorbance (A = 2 − log10T%). The Carbonyl Index (CI = A1700–1760/A1400–1450) and Dehydrochlorination Index (DI = A1580–1650/A1400–1450) were calculated by trapezoidal integration with linear baseline correction [3,4]. SEM (JEOL JCM-7000, 15 kV, high vacuum) was performed at 30×, 200×, 1000× and 4000×. **Results and Discussion:** FTIR analysis revealed significant chemical degradation exclusively in PVC_UV: CI = 1.316 (+2,276% vs. PVC_V, CI = 0.055) and DI = 0.291 (40-fold increase vs. PVC_V, DI = 0.007). The C–Cl band (600–700 cm−1) decreased by 30%, confirming chlorine loss through dehydrochlorination, while the O–H band (3200–3600 cm−1) increased by 151%, evidencing surface oxidation. PVC_S showed indices equivalent to PVC_V (CI = 0.037), with no detectable bulk chemical degradation within the evaluated period. SEM showed a morphological progression consistent with the FTIR data: at 200×, PVC_V and PVC_S kept spherical granular morphology while PVC_UV showed polymer films between particles, indicating surface melting; at 1000×, PVC_UV exhibited a collapsed sub-granule structure; at 4000×, PVC_S displayed incipient delamination despite being chemically unaltered – direct evidence that mechanical degradation precedes bulk chemical change under natural solar irradiation – and PVC_UV presented fractured zones and circular surface pores attributed to HCl outgassing [1]. **Conclusion:** FTIR and SEM gave complementary, consistent characterization of PVC MP photodegradation. UV-C caused severe chemical degradation (CI +2,276%; DI +40×) with pronounced morphological damage, while natural solar radiation induced mechanical surface fragility detectable only by SEM – morphological degradation precedes chemical alteration under environmental irradiation. The results define a degradation hierarchy (PVC_UV >> PVC_S > PVC_V) and highlight multi-analytical approaches for assessing the environmental behavior and ecological risk of weathered PVC MPs [2].

Funding Source: Multiuser Laboratory of Infrared Absorption Spectroscopy (LAMIV, UFPR) for the FTIR analyses; Materials Characterization Laboratory (Prof. Walter Contrezas Zapata) for the SEM analyses; CNPq.

Keywords: PVC microplastics; Photodegradation; FTIR spectroscopy; Scanning electron microscopy; Aquatic contamination

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PHOTOELECTROCATALYTIC REMOVAL OF POLYETHYLENE MICROPLASTICS USING TiO2 NANOTUBE PHOTOELECTRODES IN A RECIRCULATING SYSTEM: CURRENT DENSITY EFFECT ON PERFORMANCE AND ENERGY DEMAND

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Introduction: Microplastic (MP) contamination is a major environmental concern because these persistent polymeric particles are not efficiently removed by conventional water treatment [1]. Photoelectrocatalysis (PEC) is a promising alternative, since the combination of light irradiation and applied current improves charge separation and oxidative performance [2]. TiO2 nanotube photoelectrodes are especially attractive due to their stability, photoactivity and suitability for immobilized systems [3]. This study assessed the electrochemical behavior of TiO2 nanotube photoelectrodes and their performance for polyethylene MP removal under different current densities, aiming to identify the most efficient condition in terms of removal and energy consumption. **Methodology:** Electrochemical characterization was performed in 0.5 M Na2SO4 by cyclic voltammetry in a three-electrode cell, using specific capacitance to estimate the electrochemically active area. PEC degradation tests were conducted in a recirculating two-electrode reactor under simulated sunlight (Xe lamp, 1000 W m-2) using 200 mL polyethylene suspensions (20 mg L-1) at 200 mL min-1 for 3 h. Current densities from 0.05 to 0.4 mA cm-2 were applied, and performance was assessed by normalized concentration profiles based on Platinum-Cobalt Units (PCU), polyethylene mass loss and energy consumption. **Results and Discussion:** Cyclic voltammetry revealed non-ideal capacitive behavior associated with semiconducting characteristics, resistive losses and slow charge transport. Current density strongly affected PEC performance. The lowest current density, 0.05 mA cm-2, provided the best result, reaching 92% polyethylene mass loss, whereas 0.1, 0.2 and 0.4 mA cm-2 led to 56, 57 and 76% loss, respectively. The concentration profiles also showed a faster decrease at 0.05 mA cm-2, while the other conditions exhibited lower efficiency and a tendency toward plateau behavior. These results indicate that increasing current density did not proportionally improve removal and may have reduced efficiency because of transport limitations and less effective use of reactive species. In addition, the highest removal was achieved with the lowest energy demand, showing that milder conditions favored a more efficient PEC response. **Conclusion:** The results demonstrate that TiO2 nanotube photoelectrodes are active materials for polyethylene MP removal in a recirculating PEC system under simulated solar irradiation. Among the investigated conditions, 0.05 mA cm-2 was identified as optimal, combining the highest removal efficiency with the lowest energy consumption and providing a basis for further optimization and mechanistic studies.

Keywords: Photoelectrocatalysis; Microplastics; Polyethylene; TiO2 nanotubes

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POLYPROPYLENE AND POLYETHYLENE PARTICLE SIZE AFTER DISSOLUTION AND NANOPRECIPITATION

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Introduction: The widespread presence and accumulation of plastic micro and nanoparticles (MNPs) in various ecosystems has emerged as a critical global environmental and public health concern. In order to accurately assess their toxicological effects and environmental behavior, it is fundamental to synthesize reliable reference materials that mimic real-world contaminants. Among plastic commodities, polypropylene (PP) and low-density polyethylene (LDPE) are shown as two of the most consumed worldwide [1]. In spite of their abundance, due to their low solubility in common organic solvents at room temperature, generating controlled sub-micron particles from these polymers remains a technical challenge. In this context, nanoprecipitation represents a promising, straightforward and reproducible method for preparing polymeric nanoparticles [2]. However, the influence of processing parameters such as the quality of the anti-solvent on the final morphology and size of PP and LDPE particles is still not fully understood. Therefore, this study aims to evaluate the feasibility of producing PP and LDPE MNPs via nanoprecipitation using xylene as a solvent, specifically investigating how, at a fixed polymer concentration of 20 mg/mL, the use of water and ethanol affects the resulting hydrodynamic diameter, size distribution and chemical structure of the material. **Methodology:** Both polymers were first dissolved in boiling xylene to a determined concentration and immediately injected into distilled water and ethanol A.C.S. under sonication (Ultrasonic Processor VCX 750) and ice bath. Samples of the content were then collected with no filtering to be analyzed by Dynamic Light Scattering (DLS), which is used to measure the hydrodynamic particle diameter and particle size distribution (Anton Paar Litesizer 500). After drying at room temperature, the solid resulting content was collected and analyzed with Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (FTIR-ATR, Bruker) in order to confirm the characteristic peaks related to the polymer matrix of PP and LDPE. The surface of the dissolved and dried polymers was also observed by Scanning Electron Microscopy (SEM). **Results and Discussion:** The results of the DLS after the injection in water were respectively 230 and 310 nm for the PP and LDPE samples; and after the injection in ethanol were respectively 299 and 436 microns for the PP and LDPE samples, revealing particle aggregation and sedimentation using ethanol as the anti-solvent, as long as high variability in the measurements. By FTIR-ATR the characteristic peaks of PP and LDPE of the dried content were clear, whereas the spectrum of the dissolved material after drying suffered from interference and low intensity, probably due to solvent reminiscence [3–5]. SEM images revealed an irregular surface for both polymers after the drying procedure, but no clear nanosized material, indicating aggregation after drying. **Conclusion:** It is possible to attest the nanoprecipitation method for obtaining nanosized particles for both polymers in water and micro-sized particles and aggregates in ethanol without additives. Furthermore, the FTIR-ATR technique can be used to identify the chemical nature of the particles produced and attest for any remaining contaminants acquired during the processing.

Keywords: Microplastic; Polypropylene; Polyethylene; Nanoprecipitation

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PVP NANOGELS AND BIODEGRADABLE FILMS FOR AGRICULTURAL APPLICATIONS: A LITERATURE REVIEW

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Introduction: The environmental impacts of conventional plastics have driven the development of biodegradable materials for agricultural applications, including PBAT- and PLA-based polymers [1,2,3]. Polymeric nanogels are cross-linked structures on a nanometric scale with high water absorption and retention capacity. Poly(vinylpyrrolidone) (PVP) is a polymer that exhibits high water solubility, chemical stability and potential for encapsulation of compounds [4,5]. The synthesis of nanogels by ionizing radiation eliminates the need for chemical initiators and cross-linking agents. Controlled nutrient release systems are also being studied to increase fertilizer efficiency and reduce environmental losses [6,7]. This literature review aimed to gather information to support the experimental development of a material that combines PVP nanogels, fertilizers and biodegradable films in a single structure for agricultural application. **Methodology:** A literature review of scientific articles and reviews on polyvinyl pyrrolidone (PVP) nanogels (NG) synthesized by ionizing radiation, biodegradable films and controlled nutrient release systems was conducted. **Results and Discussion:** The literature demonstrated that PVP nanogels have potential for water retention and nutrient incorporation [4,5]. Studies on controlled-release systems indicate greater efficiency in fertilizer utilization and reduced environmental losses [8]. Biodegradable films based on PBAT and PLA can act as soil cover, reducing water evaporation and the generation of plastic waste after cultivation [9,10]. **Conclusion:** For the synthesis of PVP nanogels, aqueous diluted PVP will be irradiated by gamma and/or electron beam at IPEN. The PVP nanogels will incorporate the intended nutrient, and mulch biodegradable films will be incorporated with the PVP nanogel–nutrient system. Experimental studies will be conducted to evaluate the properties and performance of the developed material.

Keywords: PVP nanogel; Biodegradable films; Nutrient incorporation; Radiation-synthesized

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RELATIONSHIP BETWEEN BIOLOGICAL PARAMETERS AND ANTHROPOGENIC PARTICLE INGESTION IN LAGOCEPHALUS LAEVIGATUS FROM THE SOUTHEAST-SOUTHERN BRAZILIAN CONTINENTAL SHELF

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Introduction: Lagocephalus laevigatus is a coastal demersal-pelagic pufferfish of economic importance in some regions, yet it remains poorly studied regarding contamination by anthropogenic particles. Due to its occurrence across different habitats of the continental shelf, it represents a suitable model for assessing distinct types of anthropogenic pressure [1]. Its gastrointestinal content reflects both feeding behavior and the residues available in the environment. Despite advances in this field, the relationships between anthropogenic particles and individual characteristics, such as body size, physiological condition, feeding status and sex, remain poorly understood. Thus, this study evaluated the relationship between biological characteristics and the ingestion of anthropogenic particles in L. laevigatus. **Methodology:** Specimens were obtained from commercial fisheries between Alcatrazes Island (SP) and Barra de Laguna (SC), Brazil, from February 2022 to December 2022. In the laboratory, 73 individuals were weighed, measured and sexed. Gastrointestinal fullness degree, digestion degree, gastrointestinal content weight, digestive tract weight with food and allometric condition factor were assessed [2]. Gastrointestinal contents were processed and examined under a stereomicroscope for the identification and measurement of anthropogenic particles [3]. Relationships between biological variables and particle abundance and size were evaluated using Spearman correlations, considering all individuals together and subsequently males and females separately. Potential sex-related differences were tested using ANCOVA, with significantly correlated variables included as covariates [4]. **Results and Discussion:** Considering all individuals, only gastrointestinal content weight showed a significant correlation with the number of ingested particles ($r_s = -0.417$; $p = 0.030$), indicating fewer particles in individuals with greater food content. No significant associations were observed with total length, body weight, condition factor, fullness degree or digestion degree. Particle size was negatively correlated with total length ($r_s = -0.258$; $p = 0.022$) and body weight ($r_s = -0.276$; $p = 0.014$), suggesting that larger individuals ingest smaller particles. ANCOVAs detected no differences between sexes in either the number or size of ingested particles, nor in the slopes of the fitted regressions. These results suggest similar exposure to contamination sources and indicate that factors related to feeding behavior, environmental availability of particles and body size exert a greater influence on particle ingestion than sex-related characteristics. **Conclusion:** The ingestion of anthropogenic particles by L. laevigatus was associated with gastrointestinal content weight, whereas particle size was related to total length and body weight. The results indicate that particle incorporation is more closely associated with feeding dynamics and body size than with the physiological condition of individuals.

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Keywords: Microplastics; Marine pollution; Feeding biology

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SEASONAL VARIATION OF MICROPLASTICS IN THE PARANÁ RIVER WATER COLUMN, BRAZIL

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Introduction: Because of their broad size range (1 – 5000 µm) and high spatial dispersion capacity, microplastics (MPs) are now considered to be ubiquitous contaminants of global concern. Recent scientific studies have reported the presence of MPs in terrestrial soils, marine waters and various inland aquatic environments around the world, ranging from pristine regions to areas under high anthropogenic pressure. Among environmental systems, rivers deserve special attention as they are considered the primary pathways for plastic waste entering the oceans and are subject to intense and continuous human influence [1]. In the hydrographic basin of the Paraná River, Brazil, the pressures exerted by rural, urban and industrial centers along its banks, combined with a high population density, have numerous negative impacts on both water quality and the ecosystem [2]. Due to its undeniable economic, social and ecological importance to the region, the main objective of this study was to investigate the extent of microplastic contamination in the Paraná River water column by assessing seasonal and vertical variations. **Methodology:** The samplings were conducted in September and December 2024 and March and June 2025. During each sampling campaign, one liter of water was directly collected from the subsurface limnetic zone (~30 cm deep) and one liter from the bottom layer using a Van Dorn bottle, totaling 2 L per campaign. The samples were then vacuum filtered through glass fiber filters (47 mm diameter; 0.45 µm mesh size). The filters were then placed in glass Petri dishes and subjected to organic matter digestion using an alkaline treatment with potassium hydroxide (10% w/v) in an oven (80 °C for 12 h), as previously described [3]. The isolated microplastics were visually analyzed under a stereoscopic microscope and manually classified by type (fragments or fibers) and color [3]. **Results and Discussion:** A total of 128 MP particles were found, of which 112, 9, 5 and 2 units (56, 4.5, 2.5 and 1 MP L^{-1}) were counted, respectively. Regarding their morphological type, the great majority (98.4%) of recovered MPs were fibers, while the remainder were fragments. The diversity of colors found were transparent (45%), yellow (22%), blue (19%), black (12%), red (<1%) and pink (<1%). The predominant types and colors observed were found to be consistent with the existing published scientific literature. Interesting differences were observed between the river strata: 37 particles were found at the surface, whereas 91 were detected near the bottom, suggesting density-related deposition processes in the sediment, widely recognized as a contaminant sink. A major temporal difference was also observed between the sampling periods: the dry season (September and June) yielded 114 microplastic units, while the rainy season (December and March) yielded only 14, possibly due to differences in river flow. Although we did not conduct chemical characterization through FTIR or Raman spectroscopy in the present study, we successfully present possible trends and factors influencing MP contamination in fluvial environments. **Conclusion:** These findings further reinforce the need for continuous monitoring of microplastic contamination in large tropical rivers, given their ecological relevance and their role in transporting pollutants across freshwater systems.

Keywords: Microplastic; Freshwater pollution; Environmental monitoring; Limnology

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TEMPORAL RECORD OF MICROPLASTIC INCORPORATION IN CORAL FROM THE ABROLHOS CORAL COMPLEX, BRAZIL

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Introduction: Reef-building corals are essential for reef formation, coastal protection and marine biodiversity conservation, yet are increasingly threatened by anthropogenic pollution, especially metals and microplastics (< 5 mm), which may become incorporated into coral skeletons [1, 2, 3]. The Abrolhos Reef Complex, the largest reef system in the South Atlantic Ocean [2], has been exposed to intensified impacts after the 2015 Fundão Dam collapse, which dispersed contaminants from the Doce River toward reef environments; sediment plumes were identified in Abrolhos after 2016. This study therefore investigates microplastic occurrence in corals from this region. **Methodology:** The analyzed sample was obtained from a colony of Montastraea cavernosa collected in the Abrolhos Reef Complex under ICMBio/SISBIO authorization No. 83758-1 of 14/07/2022. Coral growth chronology was established through sclerochronological analysis using X-radiographs to identify annual density bands. Twelve subsamples corresponding to the period between 2011 and 2022 were selected for analysis. Samples underwent digestion with 5% hydrochloric acid (HCl) to dissolve the CaCO3 skeleton, followed by vacuum filtration for microplastic extraction. Retained particles were analyzed under a stereoscopic microscope for counting and characterization based on morphology, color and size distribution [3]. **Results and Discussion:** Sclerochronological analysis identified 33 density band pairs, corresponding to approximately 33 years of coral growth, with an average linear extension rate of 0.53 cm year-1. This chronology enabled comparisons between periods before and after the arrival of the Doce River sediment plume in the Abrolhos Reef Complex after 2016. Between 2011 and 2022, a total of 324 microparticles g-1 were identified in the coral skeleton. Fibers and fragments predominated, mainly blue and black, reinforcing their anthropogenic origin and possible association with urban and industrial activities. Particle sizes ranged from 100 µm to 4939 µm, with higher concentrations between 100 and 500 µm, indicating predominance of smaller particles potentially transported over long distances by marine currents and river discharge [1]. Particle abundance was reduced until 2016 and increased progressively after 2017, especially as plastic fragments. Interannual variation in the fiber/fragment proportion may reflect changes in pollution sources, hydrodynamic conditions and transport processes. Increased rainfall intensity in the Doce River Basin after 2016 suggests that enhanced river discharge favored the transport of microplastics toward offshore reef environments, reinforcing the influence of continental inputs on reef contamination dynamics [1,3]. **Conclusion:** The results suggest that microplastic incorporation into M. cavernosa skeletons is associated with the hydrological regime of the Doce River Basin, indicating long-distance transport of contaminants to the Abrolhos Reef Complex. Coral density bands proved to be an effective tool for reconstructing temporal contamination patterns. The predominance of fibers and fragments, especially blue and black particles, reinforces the anthropogenic origin of microplastics in reef environments.

Funding Source: CAPES (Finance Code 001).

Keywords: Corals; Microplastics; Abrolhos

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ENCERRAMENTO / CLOSING

Este volume encerra o 1º Simpósio Internacional de Microplásticos em Ecossistemas Aquáticos registrando o que foi apresentado em Santos entre 9 e 13 de junho de 2026. Aos autores que submeteram seus trabalhos, aos palestrantes e ministrantes de oficinas, às instituições realizadoras e às agências de fomento que sustentaram estas pesquisas: obrigado. A ciência reunida aqui só se converte em política pública e em ação concreta porque alguém se dispôs a medir, contar e caracterizar partícula por partícula.

This volume closes the 1st International Symposium on Microplastics in Aquatic Ecosystems, recording what was presented in Santos from 9 to 13 June 2026. To the authors who submitted their work, to the speakers and workshop instructors, to the organising institutions and to the funding agencies that sustained this research: thank you. The science gathered here only translates into public policy and concrete action because someone was willing to measure, count, and characterize it particle by particle.

Até a próxima edição! – until the next edition!

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Connecting science and social responsibility to reduce plastic pollution in aquatic ecosystems

This volume brings together the 22 abstracts approved and presented at the 1st International Symposium on Microplastics in Aquatic Ecosystems, held in Santos between June 9 and 13, 2026. The collection covers the occurrence and monitoring of microplastics in beaches, rivers, sediments, treated water and atmospheric particulate matter; ecotoxicological effects on anemones, oysters, crustaceans, fish and corals; the development and harmonization of analytical methods, including interlaboratory assays and nuclear techniques; removal technologies and alternative materials; and governance and environmental education.

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