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RESEARCH & COLLABORATION PROFILE

KEY WORDS: Microplastics, Microplastic Analysis, Marine pollution, Plastic weathering, Marine Biogeochemistry



Research Snapshot. Dr. Song investigates microplastic pollution in marine and coastal environments, focusing on plastic fragmentation, environmental distribution, and analytical methods. Her research combines field observations, laboratory experiments, and spectroscopic techniques to characterize microplastics and quantify their generation and environmental occurrence. Her work spans photooxidation-driven plastic fragmentation, microplastic emissions from fishing gear, FTIR- and Raman-based analytical methods, and marine biogeochemical processes. Her current research interests include microplastic dynamics in coastal wetlands, AI-assisted analytical methods, and environmental fate and transport modeling.

RESEARCH EXPERTISE

- **Microplastic analysis and characterization:** Development and optimization of sample preparation, extraction, identification, and quantification methods, including FTIR-based identification and polymer characterization.
- **Marine microplastic pollution:** Assessment of microplastic contamination, distribution, and accumulation in coastal and marine environments, including salt marshes.
- **Environmental fate and transport:** Investigation of microplastic transport, deposition, and retention processes in marine and coastal ecosystems.
- **Plastic weathering and degradation:** Investigation of physicochemical changes, surface weathering, and degradation of plastics under environmental conditions.
- **Marine biogeochemistry:** Characterization of dissolved organic matter, nutrients, and trace metals and their biogeochemical dynamics in marine environments.

RECENT RESEARCH HIGHLIGHTS

- **Microplastic emissions from fishing gear (MPB 2025):** Quantified microplastic generation from fishing ropes under mechanical abrasion and estimated global emissions of approximately 768 trillion particles annually, highlighting fishing gear as a significant source of marine microplastic pollution.
- **Plastic weathering and fragmentation (ES&T 2020; Environmental Pollution 2022, 2023):** Quantified the generation of micro- and nanoplastics through accelerated photooxidation, revealing polymer-dependent fragmentation behavior and the effects of plastic additives on particle generation.
- **Microplastic analytical methods (MPB 2021):** Compared manual, semi-automated, and automated FTIR and Raman techniques, demonstrating that semi-automated analysis reduced analytical time and improved microplastic detection compared with manual identification.
- **Marine biogeochemistry (Frontiers in Marine Science 2023):** Investigated seasonal variations in dissolved organic carbon and nitrogen in coastal waters off Jeju Island, identifying the influences of water mass mixing and potential microbial processes on dissolved organic matter dynamics.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: Polymer Science & Environmental Weathering | Artificial Intelligence & Spectroscopic Analysis | Physical Oceanography & Numerical Modeling | Coastal Sediment Dynamics

- **1. Plastic weathering and fragmentation:** Joint investigation of polymer-dependent weathering mechanisms and micro- and nanoplastics generation under environmental conditions, combining experimental studies with physicochemical characterization and fragmentation modeling.
- **2. AI-assisted microplastic analysis:** Development and validation of automated microplastic detection and polymer identification methods using machine learning, FTIR/Raman spectroscopy, and image analysis to improve analytical accuracy and efficiency.
- **3. Microplastic transport and fate modeling:** Integration of field observations and numerical models to investigate microplastic transport, vertical mixing, sedimentation, and accumulation in marine and coastal environments.
- **4. Microplastic dynamics in coastal wetlands:** Investigation of microplastic deposition, resuspension, and retention in salt marshes, combining field measurements with hydrodynamic and sediment transport modeling.

SELECTED RECENT PUBLICATIONS

- **Marine Pollution Bulletin (2025), 217, 118049 —** Microplastic emissions from fishing ropes: Quantification, characteristics, and implications for marine pollution.
- **Environmental Pollution (2023), 327, 121590 —** Fragmentation of nano- and microplastics from virgin- and additive-containing polypropylene by accelerated photooxidation.
- **Frontiers in Marine Science (2023), 10, 1250601 —** Factors controlling the distribution of dissolved organic carbon and nitrogen in the coastal waters off Jeju Island.
- **Marine Pollution Bulletin (2021), 173, 113101 —** A comparison of spectroscopic analysis methods for microplastics: Manual, semi-automated, and automated Fourier transform infrared and Raman techniques.

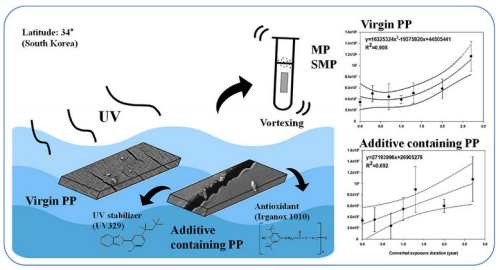
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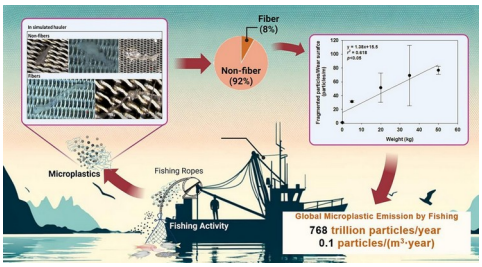
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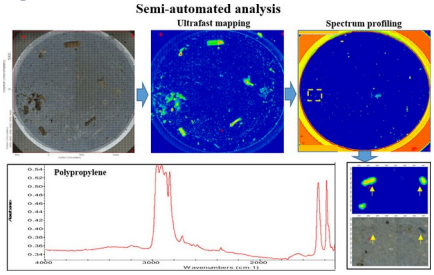
REPRESENTATIVE RESEARCH FIGURES / SCHEMES



Plastic weathering and fragmentation



Microplastic emissions from fishing ropes



Semi-automated microplastic analysis