

Abstract

[Research Title]

Development of a Continuous Measurement System for Characterization of Marine Microplastics using Raman Microscope.

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[Abstract]

The negative influence of small microplastics (SMP; < 350 μm) on marine organisms is of growing concern. However, conventional sampling using nets of 350 μm mesh size cannot provide information on the concentration of SMPs. Our objective was to construct a system to continuously measure the SMP concentration and SMP degradation on board using a micro-Raman spectrophotometer. (1) A glass flow cell and a metering pump were installed in the micro-Raman photometer. A system and method were developed to measure the concentration by batch imaging measurements of the flow cell. By changing the lattice spacing of the imaging measurements, it is possible to measure the different particle sizes (Yang et al., 2023a). (2) Detection of PE SMP was also achieved by the Beaker method (Yang and Arakawa, 2023a). (3) It was also shown that the degradation of SMP could be evaluated by Raman spectrophotometry using the carbonyl index (CI) (Yang et al., 2023b). The CI signal could be more accurately detected by baseline correction of the spectra (Yang and Arakawa, 2023b). For MPs in field water samples, we showed that the smaller the MP size, the larger the CI value (Celik et al., 2023). (4) A system to select SMP by particle concentration using filtration, chemical treatment, and fluorescence measurement was developed and evaluated. The use of fine wedge filters was efficient in filtration concentration. We developed a two-stage filtration system using a wedge filter and a membrane filter for the on-site (offshore) concentration of about 1000 L of seawater reducing it to about 10 mL. In addition, a microfluidic system was developed to sort particles

according to the Nile Red fluorescence spectrum. (5) The Raman spectrophotometer system and the two-step filtration system were operated in Sea of Japan and off the Tokai region, and the PE SMP was successfully detected. Since SMP concentrations vary widely in different areas of the ocean, the SMP concentration in the sample may require to be further concentrated for stable SMP detection and concentration measurement with this system.

[References]

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