Smart Fine Particle Collector (SFPC) for collecting microplastics in drinking water
- Features of SFPC and basic performance with Collection-Cup method -

[**Background**] In recent years, the analysis of microplastics (MPs) in aquatic and other environments has attracted considerable attention. Among the available analytical techniques, pyrolysis-GC/MS (Py-GC/MS) has emerged as a promising method for MP analysis, due to its high sensitivity, its ability to identify individual constituent polymers in mixed polymer samples, and its applicability to mass-based quantitative analysis regardless of particle size. In the Py-GC/MS analysis of MPs, there is an increasing demand for simple and efficient methods to filter, collect, and directly introduce MPs from water samples into a pyrolyzer. To address this need, Smart Fine Particle Collector (SFPC) has been developed, which is optimized for the collection of fine particles from aqueous samples. The SFPC has been designed to offer three collection methods. In this study, the processing speed and collection efficiency of one of the approaches, i.e., the Collection-Cup method were evaluated, and its performance was compared with that of conventional filtration methods.

[**Features**] The SFPC mainly consists of (1) a funnel, (2) a collecting part, (3) a flask, and (4) a vacuum pump (Fig. 1 (a)). By replacing some components of the collecting part, the SFPC can offer three different types of collection methods: (A) the Collection-Cup method, (B) the small quartz fiber filter method, and (C) the large quartz fiber filter method*1. The (A) Collection-Cup method, as shown in Fig. 1 (b), features a deactivated metal filter installed inside a sample cup for pyrolyzer (Eco Cup LHF, Frontier Lab.) which has a through hole at the bottom. This allows the particles collected on the filter to be directly introduced into the pyrolyzer along with the cup.

[**Experimental**] A metal filter was attached to the bottom of an Eco-Cup LHF to form a collection cup, which was then installed in the collecting part of the SFPC (Fig. 1). The filtration performance was evaluated using 300 mL of ultrapure water as a test sample. To assess the recovery rate, 0.150 mg each of polypropylene (PP) powder (average particle size 5 µm) and polyethylene (PE) powder (average particle size 10 µm) were dispersed in 50 mL of a water/ ethanol mixture (3:2, w/w). PP and PE particles in the mixture were collected by filtration using the collection cup of the SFPC. The weight recovery rate was determined from the weight difference of the collection cup before and after particle collection.

[**Results**] The filtration rate was 180 mL/min for ultrapure water. The average recovery rates of PP and PE particles (n=5), calculated from the weight differences, were 78% and 88%, respectively, and a good reproducibility was obtained with relative standard deviations (RSDs, n=5) of 3.7% for PP and 3.8% for PE.

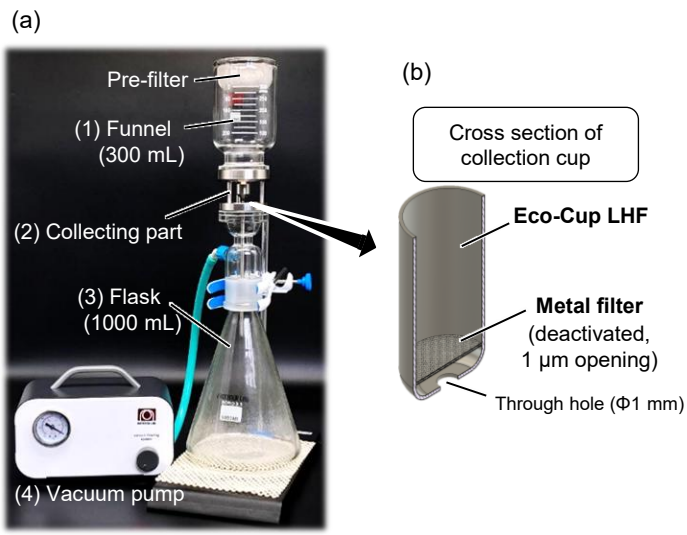

Fig. 1 (a) Front view of SFPC,
(b) Structure of collection cup.

*1: Smart Fine Particle Collector (SFPC) product flyer

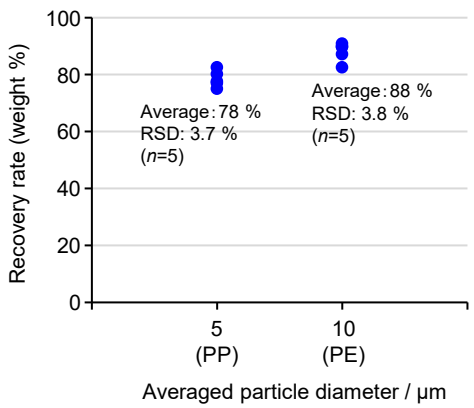

Fig. 2 Recovery rates (by weight) of PP (average particle diameter 5 µm) and PE (average particle diameter 10 µm) obtained using the Collection-Cup method.

Keywords : Microplastic, Vacuum filtration

Products used : Smart Fine Particle Collector, Eco-Cup LHF, Metal filter

Applications : Microplastics analysis, Foreign materials analysis, Polymeric materials analysis

Related technical notes :

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