PYROLYSIS-GAS CHROMATOGRAPHY-MASS SPECTROMETRY AS A RELIABLE TOOL FOR THE IDENTIFICATION AND QUANTIFICATION OF MICROPLASTICS IN WATER AND FOOD SAMPLES

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In this study, the analytical reliability of pyrolysis coupled with gas chromatography-mass spectrometry (Py-GC-MS) was evaluated for the identification and quantification of eight microplastics (MPs) in different water matrices and in blue crabs (Callinectes sapidus), the latter selected as model organism, relevant from both food and environmental viewpoints. As regards water samples, two pretreatment protocols were established based on filtration rates of the samples, designated low- and high-complexity samples [1]. Low complexity matrices were mineral water in polyethylene terephthalate (PET) bottles (BMW), demineralised water (DW), tap water (TW), and water distributed in public drinking fountains (FW), which were filtered at 0.7 µm glass fibre filters and directly analysed. High complexity matrices were wastewaters (WWs) from four treatment stages, which were subjected to microwave-assisted digestion using H_2O_2 as a reagent before Py-GC-MS. The apparent recovery percentages (R%) in DW and TW samples (90±24 and 87±25, respectively) were higher than those in WW (67±19) and showed a very similar distribution among different microplastics. Microwave-assisted digestion notably sped up the filtration of WW samples, although a less evidence of an improvement of matrix effect (ME%) was provided; however, |ME%| was >30% only and in a limited number of cases. Poly(methyl methacrylate) and PET were never detected in water samples, while different levels of contamination were found for polyethylene, polyvinyl chloride, polycarbonate, polystyrene, polypropylene, and polyamide. The lowest contamination was found in BMW. FW was more contaminated than TW (five MPs detected at 2.7-138 µg/L vs. two at concentrations between <0.62 and 23 µg/L). Blue crab samples (pulp and claws) were freeze-dried and then digested with H_2O_2, using an optimized microwave-assisted procedure, achieving R% and ME% in the ranges 25%-84% and -29%-64%, respectively. Polyethylene and polyamide were detected in crab samples at concentrations of about tens ng/mg fresh weight.

References

[1] Bonaccorso G. et al., Green Anal. Chem. 15 (2025) 100301

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