Towards harmonised methods for microplastic analysis in food: development and optimisation for seafood products

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Abstract

Recent proof of the presence of microplastics (MP) in the human body, especially in the digestive system and stool, support the theory of ingestion being a viable route for MP uptake in humans. This raises food safety concerns, particularly for seafood, as studies around the world frequently report the ingestion of plastic particles by aquatic organisms. However, for risk assessment detailed information on the occurrence of MP in edible tissues is required. Despite first quantitative assessments of MP in the edible parts of several seafood products, comparing results of different studies is difficult due to the diversity of methods and their validity. In recent years interlaboratory comparison studies highlighted the need for method harmonisation and standardisation.

This study aimed to contribute to method development and standardisation by evaluating and optimising promising approaches for analysing small plastic particles in the edible part of seafood products. Numerous techniques are described in literature; however, they are often time consuming, or require exclusive equipment, thus, limiting their applicability for routine analysis e.g., in food control. Consequently, methods are not only compared regarding analytical performance (e.g., sensitivity, precision), but also regarding complexity, accessibility and sample throughput.

For sample preparation, a combined enzymatic-alkaline digestion with consecutive filtration and oxidative treatment of the filters was the most promising approach; suitable for MP analysis with optical and mass-based methods. Within on-going research activities, the potential of fast and/or easily accessible analytical techniques, including methods like

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fluorescence microscopy, confocal laser scan, differential scanning calorimetry and quantitative NMR-spectroscopy, is compared to currently often applied techniques (FTIR, Raman, Pyrolysis-GC/MS).
Preliminary results indicate, that there is no "one-fits-all"-method for all analytical needs yet. In particular, in the case of nanoplastic analysis, significant method development is still required.

Keywords: method development, seafood, Nile Red, Raman, Pyrolysis, GC/MS, NMR