Detection of nanoplastics in food by asymmetric flow field-flow fractionation coupled to multi-angle light scattering: possibilities, challenges and analytical limitations

We tested the suitability of asymmetric flow field-flow fractionation (AF4) coupled to multi-angle light scattering (MALS) for detection of nanoplastics in fish. A homogenized fish sample was spiked with 100 nm polystyrene nanoparticles (PSNPs) (1.3 mg/g fish). Two sample preparation strategies were tested: acid digestion and enzymatic digestion with proteinase K. Both procedures were found suitable for degradation of the organic matrix. However, acid digestion resulted in large PSNPs aggregates/agglomerates (> 1 μm). The presence of large particulates was not observed after enzymatic digestion, and consequently it was chosen as a sample preparation method. The results demonstrated that it was possible to use AF4 for separating the PSNPs from the digested fish and to determine their size by MALS. The PSNPs could be easily detected by following their light scattering (LS) signal with a limit of detection of 52 μg/g fish. The AF4-MALS method could also be exploited for another type of nanoplastics in solution, namely polyethylene (PE). However, it was not possible to detect the PE particles in fish, due to the presence of an elevated LS background. Our results demonstrate that an analytical method developed for a certain type of nanoplastics may not be directly applicable to other types of nanoplastics and may require further adjustment. This work describes for the first time the detection of nanoplastics in a food matrix by AF4-MALS. Despite the current limitations, this is a promising methodology for detecting nanoplastics in food and in experimental studies (e.g., toxicity tests, uptake studies). [Figure not available: see fulltext.]

General information
Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science
Corresponding author: Löschner, K.
Contributors: Correia, M., Löschner, K.
Pages: 5603-5615
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 410
Issue number: 22
ISSN (Print): 1618-2642
Ratings:
BFI (2018): BFI-level 1
Scopus rating (2018): CiteScore 3.18 SJR 0.883 SNIP 0.962
Web of Science (2018): Impact factor 3.286
Web of Science (2018): Indexed yes
Original language: English
Keywords: Asymmetric flow field-flow fractionation, Enzymatic digestion, Multi-angle light scattering, Nanoparticles, Nanoplastics
Electronic versions:
Post_print_version.pdf. Embargo ended: 25/01/2019
DOIs:
10.1007/s00216-018-0919-8
Source: FindIt
Source ID: 2396057936
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review