First steps towards a generic sample preparation scheme for inorganic engineered nanoparticles in a complex matrix for detection, characterization, and quantification by asymmetric flow-field flow fractionation coupled to multi-angle light scattering and ICP-MS

The applicability of a multi-step generic procedure to systematically develop sample preparation methods for the detection, characterization, and quantification of inorganic engineered nanoparticles (ENPs) in a complex matrix was successfully demonstrated. The research focused on the optimization of the sample preparation, aiming to achieve a complete separation of ENPs from a complex matrix without altering the ENP size distribution and with minimal loss of ENPs. The separated ENPs were detected and further characterized in terms of particle size distribution and quantified in terms of elemental mass content by asymmetric flow-field flow fractionation coupled to a multi-angle light scattering detector and an inductively coupled plasma mass spectrometer. Following the proposed generic procedure SiO2-ENPs were separated from a tomato soup. Two potential sample preparation methods were tested these being acid digestion and colloidal extraction. With the developed method a complete SiO2-ENPs and matrix separation with a Si mass recovery >90% was achieved by acid digestion. The alteration of the particle size distribution was minimized by particle stabilization. The generic procedure which also provides quality criteria for method development is urgently needed for standardized and systematic development of procedures for separation of ENPs from a complex matrix. The chosen analytical technique was shown to be suitable for detecting SiO2-ENPs in a complex food matrix like tomato soup and may therefore be extended to monitor the existence of ENPs during production and safety control of foodstuffs, food labelling, and compliance with legislative limits.

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