Abstract

In this work, methods have been developed for the study of silver nanoparticles (AgNPs) and titanium dioxide nanoparticles (TiO_2NPs) using the sp ICP MS technique in environmental and biological samples. The NPs selected for the study represent metal and metal oxide nanoparticles, respectively. Due to its higher toxicity, more attention was paid to the speciation analysis of silver. Particular emphasis was placed on the development of quantitative methods enabling the simultaneous determination of Ag^+/AgNPs and the analysis of TiO_2NPs with different particle sizes in the systems of surface water - *Desmodesmus subspicatus* algae and in pea plants (*Pisum sativum L.*), respectively. In order to ensure reliable measurement results, procedures were optimized to eliminate various types of sources of systematic errors related to e.g. analyte adsorption, laboratory equipment contamination, calibration, extraction and interference. The procedures were also characterized in terms of metrology.

Information on the species of Ag present in natural water systems is important due to its various effects on living organisms (e.g. algae), including toxic effects. The developed methods were used to study the transformation of Ag^+/AgNPs in surface waters. The efficiency of biosorption and the share of various forms of silver in biological samples were determined at levels that may occur in natural systems. A speciation analysis of silver was carried out in algal cells and their surrounding environment. Quantification of different forms of silver in algae required optimization of the Ag release procedure from the sample matrix.

In the second part of the work, the usefulness of the sp ICP MS technique for the determination of titanium dioxide nanoparticles in plants was examined. The model plant in the study was pea (*Pisum sativum L.*) from hydroponic culture. Determination of TiO_2NPs in environmental samples using the sp ICP MS technique is burdened with numerous polyatomic and isobaric interferences. The work attempts to eliminate interference using the triple quadrupole system and the measurement of less common isotopes of titanium (^{47}Ti or ^{49}Ti). The procedure for preparing plant material for sp ICP MS analysis has also been optimized. The developed methods made it possible to study the biodistribution of titanium in various parts of plants.

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