Extraction and Single-Particle-ICP-MS characterization of Nano&Microparticles from the environment

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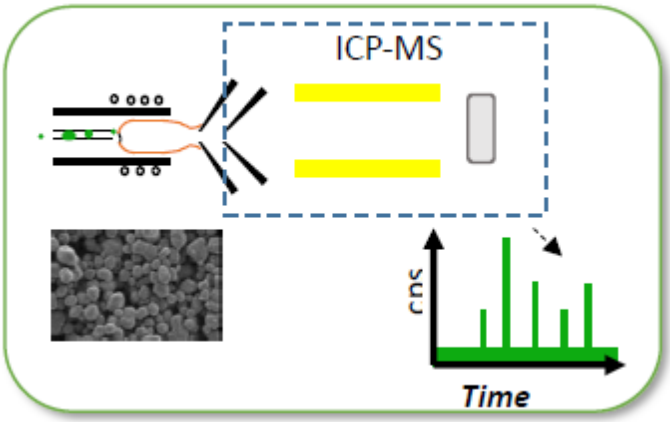
The fast growth in the production and use of engineered nanoparticles (NPs) increases also exposure of environment to these new pollutants. In the field of particle analysis very few techniques allow the simultaneous determination of size, distribution and composition of a single micro to nano size object. Single-particle analysis is therefore a growing research field. Nano materials, due to their unique properties are employed in many applications. In medicine, nanocarriers have provided a novel platform for target-specific delivery of therapeutic agents. Gold nanoparticles have emerged as a promising scaffold for drug delivery. Nano particles are also introduced in cosmetics or as antimicrobial additives in foods. For example, TiO_2 and ZnO in nanoform are extensively used in current sunscreens and their wide use spreads the nano-particles in our environment.

With the increased incorporation into everyday products, release of NPs into the environment is growing, while, the environmental and health risk associated with these materials is still not well understood.

Single-particle ICP-MS (SP ICP-MS) has the capability to study nanoparticles with respect to size, elemental composition, and particle concentrations at environmentally relevant concentrations. Using time-resolved analysis with short dwell times, a discrete pulse of intensity originating from each particle atomization and ionization in the inductively coupled plasma can be detected. The frequency of the recorded spikes is proportional to the particle number concentration, while intensity is proportional to particle size.



The ICP-MS application to NPs determination has received much attention in the past decades and we propose to develop research to be able to detect and characterize particles directly from real sample. The study may be separated in three essential and complementary objectives.

-Develop a new extraction procedure, to be able to transfer the particles from a real world food-products (vegetable oils and beverages) and their containers (plastic films, cans) without modification of the nature and particle distribution.

-Improve selectivity and sensitivity of the SP-ICP-MS method toward a wide range of particle size (nano to micro objects). In this field, recent instrumentations allow to drastically reduce dwell times and consequently improve detection of smaller particles. A consequent work on mass spectrometer' parameters will be done in our work.

-The method will then be applied to complex environment matrices where the particles are from various origins (purely metallic NPs, mixed oxides …).

Keywords: environment, spectrometry, ICP-MS, nanomaterials
References**:** D. Mozhayeva and C. Engelhard*, J. Anal. At. Spectrom.*, 2019, DOI:10.1039/C9JA00206E.