# Abstract for the general public


Due to their unique physical and chemical properties, nanoparticles (NPs), broadly defined as particles having at least one dimension between 1 and 100 nm, are currently playing a growing role in many fields including consumer products manufacturing, health protection, agriculture, food industry, environment, communication, transport and energy, leading to a rapid increase in their development, production and application. In recent years, the global production of nanomaterials has greatly increased and is estimated to reach 58,000 tons per year by 2020. As a consequence, it has led to a significant release of NPs into the environment, leading to their consideration as emerging contaminants. Once NPs enter the environment, they are going to interact in unknown ways with co-existing chemical components, e.g. other contaminants such as harmful organic pollutants, heavy metals or complexing ligands. Depending on the type of NPs and compounds interacting with them, different toxic effects can be observed. For example, NPs can act as Trojan horses promoting the transport of co-existing pollutants while facilitating toxic actions in plants, animals and humans. Therefore, these difficult-to-predict interactions between released NPs and co-existing contaminants are of major concerns nowadays due to the risk they pose to the human health and the environment itself. Although it has started to be a global problem, the interactions between NPs and co-existing contaminants are still poorly understood.

The main goal of the proposed project is the investigation of the interactions between NPs and conventional contaminants widespread in the environment by the development and optimization of analytical methodology based on advanced mass spectrometry techniques. Zero-valent iron nanoparticles (nZVI), used as adsorbents and photocatalysts, were chosen for study. Because of their efficiency in the treatment of contaminants, nZVI are used for *in situ* groundwater and soil remediation what leads to their exposure to plants and animals and thus to unknown effects on the human organism. Interactions between nZVI and contaminants (herbicides and heavy metals) will be studied *in vitro* and *in vivo* in two model plants: *Arabidopsis thaliana* (seed-producing plant) and *Solanum Lycopersicum* L. (fruit-producing, edible plant). Single particle inductively coupled plasma mass spectrometry (SP-ICP-MS) will allow to obtain information about size of nZVI as well as about concentration of nZVI and dissolved iron. For the identification of new species created as a result of nZVI-contaminants interactions outside and inside plant tissues, tandem electrospray ionization mass spectrometry (ESI-MS/MS) will be used. The unique character of the analytical techniques and novel procedures that will be developed during the project will allow us to expand the knowledge in the primary area of the NPs impact on the ecosystem.

This research brings together the knowledge from different areas of science: analytical chemistry, nanotechnology and biology. The analytical methodology developed in the frame of the proposed project will allow for a better understanding of the ecological risk associated with application of NPs and their impact on the environment and human health, which in turn will allow for more effective planning of a rational use of nanoparticles.