



(Recent Photograph)

Sample Abstract

(List of items to include in your abstract)

Abstract Title:

New scenarios for crop plants: TiO₂ nanoparticles in sludge-amended agricultural soil

Presenters (Monica Ruffini Castiglione, PhD, Department of Biology, University of Pisa, Italy)

Short Description of what will be discussed during the presentation (about 250 - 500 words)

Beyond all studies published to date on the effects of nanoparticles (NPs) on living organisms, the overall picture of their possible interactions with crop plants and with food chains are not at all clear.

These emerging contaminants are becoming a worldwide problem, given that nanotechnologies are increasingly gaining ground in all sectors of the economy and innovation, with their consequent unintentional and intentional release into the environment. Poorly estimated is indeed the behavior of nanomaterials (NMs) in the different environmental matrices, especially in agricultural soils. These become a site of possible accumulation of NMs through potentially contaminated surface waters, by the use of plant protection products, and by their amendment with sludge from wastewater treatment plants. The recycle of sludge in agricultural soils is identified as one of the best environmental management practice, due to its increasing amount of production and the supply of organic matter and nutrients to the soil-plant system, but, due to the uncertainty of its contents not thoroughly tested for safety, can result a possible sink of unknown pollutants as well as of NPs. In such complex matrices the bioavailability of the different NMs often is not predictable, due to the tendency of NPs to aggregate, to adsorb/precipitate on solid phase, as well as to be coated by organic molecules.

In order to investigate the environmental impact of TiO₂ NPs we have used two different concentrations of the crystal forms of TiO₂ (applied singularly or in a mixture as anatase and rutile NPs and as bulk material). The effects were evaluated on growth and development of the crop *Pisum sativum* at microcosm scale under long term exposure, to possibly mime environmental exposure in sludge amended agricultural soil. We were particularly interested in understanding the response elicited by NPs in tissues/organs, at cellular and organism level, taking into account different aspects. Ultrastructural studies demonstrated that the applied NPs were internalized in root cells and synchrotron studies showed that both titanium crystal forms, especially anatase, were taken up and moved to the vascular tissues. Oxidative stress was evaluated by biochemical approach and *in situ* histochemical techniques. The amended sludge soil was in itself an element of disturbance for plants. The presence of NPs in the sludge-amended soil pronounced oxidative damages in *P. sativum*, in particular that grown at the lowest NPs concentration. This result was speculatively attributed to a likely easier enter the root of more diluted NPs, having less tendency to form homo- and heteroaggregates in the complex matrix. The most responsiveness treatments

seemed those conducted with anatase crystal form, alone or mixed with rutile as well as with the corresponding bulk material. The results of our work pose a reflection on the promising agronomic practices and on the use of nanomaterials and their safety, which must be carefully analyzed, in order to establish right regulation over their use, confinement, and disposal for the environmental protection and living organism health.

What will the audience take away from your presentation? (Try to list 3-5 specific items)

- I hope that conference audience, depending on the proper skills, will be able to enter the proposed issues, getting the key messages, especially useful for colleagues working on or approaching to environmental problems related to emerging contaminants and higher plants.
- Our presentation aims, among other things, to show how to proceed with a multidisciplinary approach applied to a complex problem, by means of both traditional and innovative techniques.
- Due to the complexity of the study system, interdisciplinary competences are needed. In this respect our work may also be of interest for researchers coming from other faculties.
- The presentation of our work poses a reflection on the promising agronomic practices and on the use of nanomaterials and their safety, which must be carefully analyzed for the environmental protection and living organism health

Is this abstract connected to an organized session? If yes, please provide full session title.

Biography of presenting author (about 100 words)

Monica Ruffini Castiglione is senior researcher and lecturer at Botany Department, University of Pisa. Graduated in Biological Sciences in 1987, she received her PhD degree in 1993 and from 1993 to 2000 different post-doc positions. From 2001 to 2007 staff member and from 2008 researcher position at the Department of Biology, University of Pisa. Her recent areas of interest concern the study of the stress-induced morphogenic responses following exposure to different abiotic stressors in higher plants and their employment in toxicity assessment by different endpoints. She is author and co-author of more than sixty publications *in extenso* and more than sixty contributions to international and national conferences.

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