# *Aloe vera*-mediated green synthesis of amorphous iron oxide nanoparticles for sustainable nano-fertilization

Authors: Vincenzina Strano [1], Vanna Torrisi [1], Simona Boninelli [2], Maria Miritello [1].

Affiliations:

[1] Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi (CNR-IMM), sede di Catania-Università, Via S. Sofia 64, 95123 Catania, Italy.

[2] Catania-Headquartes, Ottava strada n.5, I-95125 Catania, Italy.

**Short abstract** (max 250 words)

The possibility of using nanoparticles as fertilizer for improving the agricultural production has attracted great scientific interest, considering the growing global food demands [1]. In particular, nano-sized metal oxides represent promising materials for nano-fertilization, demonstrating enhanced uptake efficacy compared to their bulk counterpart, also thanks to the high surface-to-volume-ratio [2]. A proper design of nano-fertilizers is crucial to ensure the effective and controlled release of the micronutrients for the plants. Recently, the realization of hybrid nanocomposites based on metal oxide nanoparticles encapsulated on biopolymeric shell has been proposed as an innovative and sustainable approach for nanoscale fertilizer [2]. On the other hand, regarding the production of metal oxides nanostructures, the scientific community is interested in reliable and environmentally friendly approaches. In particular, in the green synthesis chemical reducing agents and stabilizers are replaced by proteins, vitamins, alkaloids, carbohydrates, and antioxidants obtained from living organisms and plants [3]. The aim of this work is to attain the green synthesis of iron oxide nanoparticles employing an aqueous extract of *Aloe vera* leaves. The activity is in the framework of the development of fully-clean nanocomposite based on iron oxide as nanoscale fertilizer. Iron is an essential nutrient for plant growth and nanosized-iron oxide may be an effective fertilizer with a more efficient absorption by plants roots and leaves [4]. The green-synthesized nanoparticles were characterized by scanning and transmission electron microscopies (SEM and TEM), energy-dispersive X-ray (EDX) and Raman spectroscopies, X-ray diffraction (XRD) analysis.

This work was performed in the framework of PNRR Samothrace Project.

[1] Boutchuen A. et al, *Journal of Nanomaterial*, Volume 2019, Article ID 6890572, 11 pages.

[2] Leonardi M. et al, *Environ. Sci.: Nano*, 2021, 8, 174–187.

[3] Shanker U. et al, Green Nanomaterials for Industrial Applications, Chapter 5, Elsevier 2022.

[4] Rui M. et al, *Front. Plant Sci.*, 2016, 7, 815.