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DIPARTIMENTO DI GEOSCIENZE

Seminario

Characterization of engineered hydroxyapatite nanocrystals through synchrotron Wide Angle X-ray Total Scattering methods

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Aula Arduino

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Abstract:
Hydroxyapatite – HA – (Ca10(PO4)6(OH)2, the mineral constituent of bones and teeth, is one of the most studied biomimetic materials for its biocompatibility and versatility. In fact, the ability of incorporating a number of exogenous ions into its crystal structure makes HA an interesting material to achieve desired material properties through designed synthetic pathways. This is particularly effective if HA is confined at the nanoscale. On these bases, nanotechnology can offer a great contribution towards a sustainable agriculture by improving the current fertilizing techniques, based on highly soluble N- and P-rich compounds, that are mostly inefficient and pollutant. Within the HYPATIA project (size-controlled HYdroxyaPATItes for sustainable Agriculture), HA-based nanocomposites (a mixture of amorphous – ACP – and nanocrystalline components) where synthetized according to green chemistry principles and functionalized with N-rich compounds, aiming at developing innovative, more efficient and sustainable fertilizers for agriculture application. The nanocomposite characterization is carried out through both conventional physico-chemical analyses and advanced scattering techniques, such as synchrotron-based Wide Angle X-ray Total Scattering (WAXTS) and Small Angle X-ray Scattering (SAXS). Advanced modelling techniques based on the Debye scattering equation characterize these nanomaterials in terms of composition, crystal structure, size and morphology. The in-depth characterization coupled to the stability and nutrient release kinetics provides information on the structure-properties relation, enabling a controlled macronutrient release by modulating the size, structure and composition of nanoparticles through a synthesis-by-design approach, making them a promising smart and sustainable fertilizer.

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