Nano-hydroxyapatite from organic waste for sustainable P-fertilization

Laura PILOTTO - University of Udine

Nano-enabled agriculture (NEA) describes the potential application of nanotechnologies in agriculture to improve agrochemicals performance. Furthermore, it seems that nature-derived nanomaterials could be more promising than synthetic ones in NEA, but there is still a significant lack of knowledge compared to other sectors. At the same time, using biowastes to produce nanomaterials represents a crucial step towards fulfilling circular economy paradigms.
Hydroxyapatite ($Ca_{10}[PO_4]_6(OH_2]$) can be extracted from biowastes, such as bovine and fish bones and scales. Promising applications in agriculture arise from the potential of nano-hydroxyapatite (nHAP) that can be used as a P-source for crops or as a carrier for other macro/micro-nutrients or molecules for plant protection. Compared to the stoichiometric nHAP, bio- nHAP can contain other ions, such as Mg^{2+}, K^{+}, and CO_3^{2-}. Furthermore, the composition and the degree of crystallization are also determined by the type of raw material and synthesis conditions. Nevertheless, nHAP results as poorly soluble in soil. *Pseudomonas putida* is a microorganism known in the literature as able to solubilize different forms of P-compounds, including also hydroxyapatite. In this context, our work aims to test nHAPs from animal waste (chicken bone) as a source of phosphorous for plants. In these first steps, nHAP was extracted from chicken bones, and a soil-leaching experiment was set up to test the behaviour of these materials compared to the traditional fertilizer triple super phosphate (TSP) in soil columns with and without *P. putida*.