

Agriculture applications of nano-structured calcium phosphates derived from fish industry by-products

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Nowadays, the development of new nanomaterials able to increase nutrients uptake and efficiency use by plants is one of the major trends in agriculture. The use of calcium phosphates for these applications has recently gained attention as these particles are widely renowned for their intrinsic biocompatibility and biodegradability, being the inorganic constituents of biological hard tissues such as teeth and bones, so that their use doesn't raise any safety issue. Calcium phosphates contain phosphorous, a primary nutrient for plants and a key element in crop fertilization, whose availability on the planet is diminishing due to its extensive extraction from finite mineral deposits to meet the world fertilizer demand. Therefore, it is of fundamental importance to develop the circular economy of this element and enlarge its pool of resources with alternative and renewable ones, such as food by-products. In this respect, fish bone is an abundant and phosphorous-rich by-product from fish processing, containing up to the 18 wt% of phosphorous in the form of calcium phosphate. In this talk I will report on the preparation of calcium phosphate particles extracted from fish bone, and their use, even in combination with natural humic substances, as fertilizer and bio-stimulants for plants growth. In a first work, we have reported that these materials showed interesting results on *Zea mays* seedlings and coleoptiles with regard to seed germination, plant fertilization and corn coleoptile bio-stimulation. Then, we have assessed that calcium phosphate particles coated with humic acids are promising materials in terms of phosphorous uptake and foliar translocation in two species of interest for horticulture (*Valerianella locusta* and *Diplotaxis tenuifolia*).