How to tailor nano hydroxyapatite as a kind of potential P fertilisers

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The efficiency of conventional phosphorous (P) fertilizers, including soluble triple superphosphate (TSP, Ca(H2PO4)2·H2O), monoammonium phosphate (MAP, NH4H2PO4), diammonium phosphate (DAP, (NH4)2HPO4), ammonium polyphosphate liquid (APP, [NH4PO3]n) and insoluble phosphate rock (PR), is low, due to either strong interactions with soil components or low availability. For soluble P fertilizers, another problem deals with the loss of P through erosion and runoff, which often causes eutrophication of adjacent waters. Nanoparticle-carrier/based P fertilizers (such as hydroxyapatite nanoparticles, HA-NPs), sitting between molecular and micrometre scales, could present a good compromise between agricultural benefits and environmental risks, that is, by possessing properties of proper availability, controlled release, and decreased loss risk. In this study, a series of HA-NPs were synthesized, with NPs surface modified with various coating agents to obtain different kinds of charges, which are expected to have a profound impact on their interactions with soil constituents. Results regarding (1) release kinetics of P when these NPs are applied into P-deficient soils with various cation exchangeable capacity (CEC) and (ii) plant growth will be presented and discussed.
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