Bone bioapatite: A potential P hotspot assisted by bacteria

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Abstract

Over 90% P on the earth is stored in apatite. Phosphate-solubilizing microorganisms (PSM) have the ability of creating P releasing hotspots via enhancing the solubility of apatite to alleviate P limitation in both agricultural and natural systems. Charred bone (CB with bioapatite), with relatively high P content and solubility, is considered as a potential P source. However, the balance between heating temperature and the P release dynamics of CBs with addition of phosphate-solubilizing bacteria (PSB) was still not clear. P release from CB produced at various temperatures (100–300 °C) with the assistance of PSB was compared in this study. In the absence of PSB, soluble P from CB in water fluctuated between 100 and 300 °C and reached a maximum value (8.7 mg/L) at 200 °C. Similarly, CB produced at 250 °C showed the highest solubility and dissolution rate via dissolution kinetics. The addition of PSB elevated soluble P from all the CB samples. However, the most significant increment in soluble P was observed from CB produced at 100 °C (from 3.5 to 77.4 mg /L). It indicated that the collagen could improve the efficiency of P release from CB surface by substantially adsorbing PSB. Hence, the transformation and transport of P at the bio-mineral interface would be focused on in the following studies. Moreover, the addition of charred bone to soil was also investigated. The physico-chemical properties significantly improve/degrade the P release from bioapatite, depending on the types of soil. Finally, we can elucidate the bio-weathering of apatite and P cycle in ecosystem.