

Passivation of cadmium in river sediment using phosphate-solubilizing bacteria and nano-hydroxyapatite loaded biochar (HAP@BC)

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Abstract: Cadmium (Cd) has strong bioaccumulation property and long-lasting toxicity, which is a serious threat to human health, thus it is extremely urgent to remediate the Cd contaminated river sediments. Nano-hydroxyapatite loaded biochar (HAP@BC) was synthesized and coupled with phosphate solubilizing bacteria (PSB) to enhance the passivation efficiency of cadmium in this research. It has much advantages compared to using HAP@BC only due to the higher dissolution efficiency of phosphorus by PSB. In addition, the passivation efficiency of cadmium via HAP@BC and PSB under different conditions and its mechanism were also investigated. The results showed that the highest Cd²⁺ removal efficiency could reach 90% in liquid medium when using PSB cooperated with 5:1 HAP@BC in the condition of temperature 15~37 °C, pH 7, initial Cd²⁺ concentration less than 0.5 mM. Furthermore, the simulated sediment experiment indicated that the acid soluble fraction of Cd was reduced by 28% and transformed into more stable forms, such as residual fraction. All the experiments of this work demonstrate that the PSB cooperated with HAP@BC is an excellent candidate of passivation agent and could be considered as an effective way for Cd immobilization in contaminated soil in the future.

Keyword: River sediment; Cadmium; Immobilization; Phosphate-solubilizing bacteria; Nano-hydroxyapatite loaded biochar.