Biomineralization based heavy metals remediation from soil

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Ever increasing urban expansion, industrial development and anthropogenic activities are major sources of polluting soils with heavy metals. Posing with serious environmental problems, heavy metals require ultimate solution for the removal from soils to protect both health and environment. The remediation methods either could decontaminate (reduce the amount of metals by removing from soils) or stabilize (reduce or eliminate environmental risks by altering the soil chemistry and sequester or absorb the metals into the matrix) the heavy metals. Nevertheless, the physic-chemical remediation technologies are rarely adopted because of many disadvantages associated with them. In this study, microbially induced calcite precipitation (MICP) has been proved as a promising approach for remediation of various heavy metals (Cu, As, Cr(VI), and Pb) with advantages on current bioremediation techniques. The ubiquity and importance of microbes in inducing calcite precipitation by producing an enzyme, urease, make MICP active in every environment. The mobility of heavy metals significantly decreased in the exchangeable soil fraction, while at the same time metals concentration was markedly increased in carbonated fraction after bioremediation. The biomineralization products in remediation was further confirmed by SEM-EDS, ATR-FTIR and XRD analyses. XRD spectra showed presence of various biomineralization products such as calcite, gwihabaite, aragonite and vaterite. The results from this study present MICP as a viable strategy for the remediation of the heavy metals contaminated sites.