S20-1
BioNanoFactory: New insight into biological synthesis of nanomaterials

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Key word: bionanofactory, nanostructures, dissimilatory metal-reducing bacteria, Shewanella

The use of nanostructured materials is becoming more widespread having unique physical and chemical properties. It is well known that biological systems can provide a number of metal or metal-containing particles in the nanometer size range. Dissimilatory metal-reducing bacteria, Shewanella spp. have received more attention on environmental remediation since they are capable of reducing many heavy metals and radioactive elements to immobilized forms and producing diverse nano-sized secondary minerals. Shewanella sp. strain HN-41 formed long, variable diameter, extracellular As-S filamentous nanotubes when grown anaerobically in the presence of thiosulfate and As(V). As-S nanotubes behaved as metals and semiconductors in terms of their electrical properties and were photoconductive. In addition, chalcogenide ternary and quaternary nanotubes were synthesized through bacterial reduction and/or abiotic ion exchange of As-S nanotubes. Shewanella strains also able to utilize U(VI) as an electron acceptor for respiration and formed long, extracellular, U(VI) nanowires under anaerobic condition. Better understanding of these interactions between biological materials and metals or minerals could suggest the green route for synthesis of functional nanomaterials as well as best solution for environmental remediation of metal contamination in natural subsurface environments.

S20-2
Iron reduction and formation of nanometer-sized magnetites by metal-reducing bacteria isolated/enriched from inter-tidal flat sediments

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Key word: magnetite, nanoparticle, biomineralization, metal-reducing bacteria, inter-tidal sediments

The objectives of this study were to explore microbial reduction of Fe(III) oxide hydroxides and biomineralization of magnetite nanoparticles by the metal-reducing bacteria isolated/enriched from the inter-tidal flat sediments, southwestern and south coast of Korea. Taxonomic characterization of the strains isolated/enriched from inter-tidal flat sediments indicated that they belong to genus of Shewanella sp., and Clostridium sp. The bacteria were able to reduce iron oxides and metal-incorporated iron oxides using short chain fatty acids as the electron donors. The bacteria formed nm-sized magnetite and metal-substituted magnetite by reduction of iron oxides and metal-substituted magnetite, especially, under the conditions at room temperature and medium pH=8.5 within 1-month incubation time. It was found that the microbially synthesized magnetite particles were coated with organic containing an abundance of reactive carboxyl groups without any chemical process for functionalizing them. These results suggest that microbial reduction of Fe(III) reduction and formation of nm-sized magnetites by microbial processes at near ambient temperatures may influence the biogeochemical cycles of carbon and metals in subsurface environments. Knowledge concerning such bio-solid state processes may be important in the synthesis and production of nm-sized ferromagnetic materials.