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Anoxic oxidation of arsenite linked to chemolithotrophic denitrification: the missing link in the biogeochemical arsenic cycle?

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Abstract

Anoxic Oxidation of Arsenite Linked to Chemolithotrophic Denitrification: The Missing Link in the Biogeochemical Arsenic Cycle? Arsenic contamination of groundwater and surface water is a worldwide problem. Localized elevated arsenic concentrations have been attributed to the natural release of arsenic from the weathering of arsenic bearing minerals. Microorganisms play significant roles in controlling the fate and transport of arsenic in the environment. The objective of this study is to evaluate the importance of anoxic oxidation of arsenite (As(III)) to arsenate (As(V)) by chemolithotrophic denitrifying bacteria in the biogeochemical cycle of arsenic. In this study, denitrification linked to the oxidation of As(III) to As(V) was shown to be a widespread microbial activity in anaerobic sludge and sediment samples. The biological oxidation of As(III) utilizing nitrate as sole electron acceptor was feasible and stable over prolonged periods of operation in continuous-flow anaerobic bioreactors. A bioremediation strategy was explored that is based on injecting nitrate to support the microbial oxidation of Fe(II) and As(III) in the subsurface as a means to immobilize arsenic. Microbial oxidation by denitrifying microorganisms lead to the formation of ferric (hydroxides) which adsorbed As(V) formed from As(III)-oxidation. The studies demonstrate that anoxic microbial oxidation of As(III) and Fe(II) linked to denitrification significantly enhance the immobilization of arsenic in the anaerobic subsurface environments.

Biography

Wenjie Sun has completed his Ph.D. degree in Environmental Engineering with minor in Soil, Water and Environmental Science from The University of Arizona. Dr. Sun has published more than 16 papers in reputed journals and serving as editorial board member for reputed journals e.g. Journal of Bioremediation & Biodegradation. Dr. Sun's research interests center on exploring the interfaces between microbiology research and practical applications to solve environmental problems with focuses on anaerobic bioremediation and biodegradation of environmental contaminants, biological treatment of pollutants in water and wastewater, solid and hazardous waste disposal and management, and environmental application of molecular microbial biology