Biosynthesis of FeS complex and Its Arsenic Removal Efficiency

HYUNHEE SEO AND YUL ROH*

Department of Earth and Environmental Sciences, Chonnam National University, Gwangju, 61186, Korea
(*correspondence: rohy@jnu.ac.kr)

Bio-nano particles have attracted great attention due to their eco-friendly, economical and effectual properties for groundwater remediation. Among bio-nano particles bio-magnetite has been proved as an effective catalyst in in-situ/ex-situ remediation [1]. However, few bio-nano catalysts except bio-magnetite in groundwater remediation have been reported. In this study bio-FeS complex was synthesized and its mineralogical characterization were examined. Also, the removal efficiency of As(III/V) were tested using bio-FeS complex.

Microorganisms enriched from intertidal flat sediment in Gochang, S. Korea were used to synthesize bio-nano particles in a growth medium containing chemically synthesized akaganeite and sodium thiosulfate pentahydrate as dual electron acceptors and glucose as an electron donor under anaerobic condition at 25ºC for 1 week. Mineralogical and morphological characterization of the bio-nano particles were conducted by XRD and TEM-EDS. Also, the removal efficiency of As(III) and As(V) were tested using 4 g/L of bio-FeS complex with 0.01 M of initial concentration of As(III) and As(V) solutions for 24 h. Sample aliquots were measured for remained arsenic in solutions by ICP-OES/MS.

Microbially synthesized nano particles were identified as crystalline mackinawite (FeS) and amorphous FeS complex by XRD analysis. Also TEM images of the bio-FeS complex presented 50-100 nm in size and rod or overlapped petal like in shape. Its chemical composition mainly composed of Fe and S by EDS spectra. The removal efficiency of As(III) and As(V) using bio-FeS complex revealed 99% and 93% respectively. XRD results indicated that the precipitates reacted with As(III) and As(V) transformed from iron sulfide to iron arsenic sulfide through biomineralization.

These results support that bio-FeS complex has potential to enhancing the effective treatability of groundwater remediation.

[1] Hashim et al. (2011) *J. Environ. Manage.* **92**, 2355-2388.