Microbial precipitation of Se(0) and Au(0) nanospheres

BITNA PARK[1], MINHOON BAIK[2], SEUNGYEUP LEE[2] AND YUL ROH[1]*

[1]Chonnam National University, Gwangju, 500-757, Rep. of Korea (*correspondence: rohy@jnu.ac.kr)
[2]Korea Atomic Energy Research Institute, Daejeon, 305-353, Rep. of Korea

The metal-reducing bacteria, Haejae-1 and KURT-1, were enriched from inter-tidal flat sediments and groundwater, respectively. Microbial metal reduction and precipitation are expected to eco-friendly and economical methods to immobilize Se(VI) as a pollutant in groundwater and to recover Au(0) as a novel metal in a mine residue. Table 1 shows experimental setup for microbial precipitation of Se(0) and Au(0). Fig. 1 shows Se(0) and Au(0) nanospheres preciptiated by the microbial processes.

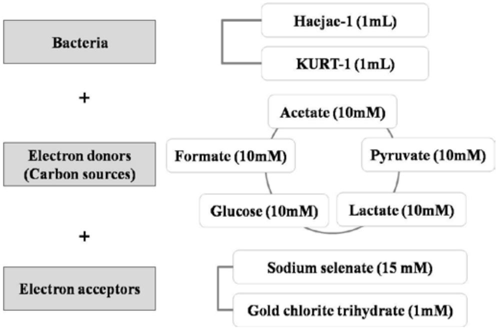

Table 1: The experimental conditions for Se(0) and Au(0) precipitation via microbial Se(VI) and Au(III) reduction.

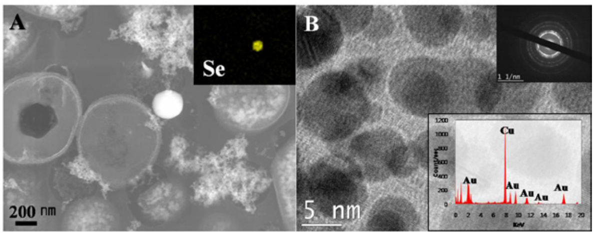

Figure 1: The TEM-EDS analyses of a Se(0) nanosphere formed by KURT-1 (A) and Au(0) nanospheres formed by Haejae-1 (B).

The metal-reducing bacteria reduced Se(VI) and Au(III) and precipitated Se(0) and Au(0), respectively. The bacteria precipitated Se(0) and Au(O) nanospheres extraceullarly. This study indcates that reductive precipitation of Se(0) and Au(0) may be useful for Se immobilization and Au recovery in the natural environments.

Aqueous-mineral interfaces toward extreme conditions: The potential experimental approaches with synchrotron X-ray probe

C. PARK[1]*, P. FENTER[2], J.G. CATALANO[3], S.S. LEE[2], K.L. NAGY[4] AND N.C. STURCHIO[4]

[1]HPCAT, Geophysical Laboratory, Carnegie Institution of Washington, Argone, IL (*correspondence: cypark@hpcat.aps.anl.gov)
[2]Chemical Sciences and Engineering, Argonne National Laboratory, Argonne, IL
[3]Department of Earth and Planetary Sciences, Washington University at St. Louis, St. Louis, MO
[4]Department of Earth and Environmental Sciences, University of Illinois at Chicago, Chicago IL

Aqueous-mineral interface reactions exert a primary control over elemental transport in the near-surface environment. These molecular scale elementary processes have been studied in recent years using synchrotron based surface and interface X-ray diffraction techniques, including X-ray reflectivity (XR) [1], resonant anomalous X-ray reflectivity (RAXR) [2], and X-ray reflection interface microscopy (XRIM) [3]. The XR and RAXR studies revealed layering structure of water near the mineral surfaces [1, 4], strong influence of surface mophology on the layered structure through molecular interactions [1, 5], complex ion adsorption structures with simultaneous inner- and outer-sphere adsorbed species [2, 6], and thermodynamically controlled inner- and outer-sphere partitioning of adsorbed ions in the electrical double layer [7]. The XRIM provides a new capability to obtain a full field image of the surface topography with ~100nm lateral spatial resolution. These previous studies were performed under ambient (or near-ambient) conditions; and high pressure and high temperature interfacial processes have yet to be surveyed. After a brief review of the above results, I will discuss the potential importance of these aqueous-mineral interface processes under extreme condtions, probed by the synchrotron X-ray techniques, in the context of the cycling and sequestration of elements in the sub-surface environment.

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