

Formation of Se(0) nanoparticles by *Azospirillum brasilense*

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We investigated the reduction of SeO_3^{2-} by *Azospirillum brasilense*. The formation of fairly soluble Se(0) nanoparticles during this process is of interest for both bioremediation of Se-contaminated sites and for nanobiotechnology.

A. brasilense was cultured in 30 mL medium at 30 C in a shaking (100 rpm) incubator for 3 days in the presence of 1 mM Se(IV). The cellular material was then separated from the red Se precipitate by using a modified procedure of Oremland *et al.* [1]. The cleaned precipitate was resuspended in deionized water. For selective Se(IV) quantification in the culture media we used hybrid generation atomic absorption spectrometry (HG-AAS) [2]. The formed Se precipitate was characterized by scanning electron microscopy with energy-dispersive X-ray spectrometry (SEM-EDX), photon correlation spectroscopy (PCS) and zeta potential measurements.

After exposing *A. brasilense* to Se(IV), the bacterial growth continued after an extended lag-phase. After a cultivation time of 3 days, a reddish staining of the sample was observed, indicating the formation of Se(0). SEM coupled to EDX confirmed the formation of nanoparticulate, red Se(0). Only 10 % of the initial Se(IV) concentration could be recovered from the culture media by HG-AAS. The separated Se(0) suspension was stable for several hours, sufficient for the PCS and the zeta potential measurements. In contrast, Se(0) chemically formed by reduction with hydroxylamine solution produced amorphous aggregates with rapidly settled down. PCS and SEM imaging showed that the Se(0) particles had a particle size distribution between 100 and 300 nm with an averaged particle diameter of 200 nm. The isoelectric point of Se(0) particles was at $\text{pH } 2.8 \pm 0.2$. The preference of forming Se(0) particles with a negative charge agree very well with the literature [3].

[1] Oremland *et al.* (2004) Appl. Environ. Microb. **70**, 52-60.
[2] Niedzielski *et al.* (2002) Pol. J. Environ. Stud. **11**, 219-224. [3] Dhanjal & Cameotra (2010) Microb. Cell Fact. **9**, 1-11.

Stable and Radiogenic Strontium isotope behaviour in the subglacial environment

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Subglacial hydrology plays a key role in determining the nutrient fluxes from glaciated terrains. Differences in the chemical and isotopic composition of the glacial outflow are controlled by variations in initial inputs, mineralogy, mineral dissolution and residence time. We present geochemical data from the glacial discharge of two geographically, geologically and climatologically distinct glaciers over two field seasons: the Athabasa Glacier, Canada (AG, Precambrian sedimentary bedrock) and the Lemon Creek Glacier, USA (LCG, Southeast Alaska metamorphic belt).

Strontium isotopes are widely utilized in studies of weathering and hydrology. Radiogenic Sr ($^{87}\text{Sr}/^{86}\text{Sr}$) is a good proxy for varying hydrological inputs and weathering reactions, however Sr *stable* isotopes ($\delta^{88/86}\text{Sr}$) can be fractionated by both precipitation and dissolution reactions. A combination of the two strontium systems should therefore provide improved constraints on the weathering environment.

Radiogenic Sr results indicate differences in glacial outflow composition with $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.7142$ and ~ 0.7106 for AG and LCG respectively. Radiogenic Sr data from the AG show clear resolvable seasonal excursions, varying from 0.716 in May to 0.712 in July. By contrast, the meltwater from the Lemon Creek shows little variability in radiogenic strontium with time. The $^{87}\text{Sr}/^{86}\text{Sr}$ in suspended sediments from the LCG are consistently less radiogenic than their water counterparts and show a similar trend toward more radiogenic values as the season progresses.

The $\delta^{88/86}\text{Sr}$ data, however clearly show the difference in the underlying bedrock geology with mean $\delta^{88/86}\text{Sr} \sim 0.19$ and ~ 0.33 for AG and LCG respectively. Analysis of $\delta^{88/86}\text{Sr}$ from suspended sediments from LCG show consistently lighter compositions than the corresponding water sample.

Variations in both $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{88/86}\text{Sr}$ in the meltwater will be analyzed using principle component analysis to reveal relationships with water mass source and elemental fluxes.