

Evidence of U(VI) sorption on *Acidovorax* by TRLFS and TEM/EELS

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Acidovorax facilis, an aerobic Gram-negative Betaproteobacterium which is commonly found in soil, was used for U(VI) sorption experiments. Experiments were performed in batch cultures under aerobic conditions at 25 °C using tap water. For U(VI) sorption experiments $\text{UO}_2(\text{NO}_3)_2$ was added to the culture to achieve an initial U concentration of 0.05 and 0.1 M, respectively, at a neutral pH range. The duration of the sorption experiments were limited to 8 h and 48 h, respectively. By time-resolved laser fluorescence spectroscopy (TRLFS) the U(VI) luminescence at 274 K was measured after excitation with laser pulses at 266 nm and with an average pulse energy of 300 μJ . The measured emission spectrum of the cells is characterized by four emission bands with peak maxima at 497.8, 519.5, 544.1 and 568.6 nm \pm 0.5 nm. In addition, the spectra of the Uranyl-lipopolysaccharide-complexes $\text{R-O-PO}_3\text{-UO}_2$ and $[\text{R-O-PO}_3]^{2-}\text{UO}_2^{2-}$, reported by Barkleit et al. (2008) [1], were used for comparison. They show only a small deviation from those observed in our studies. Hence, it can be concluded that phosphoryl groups are the main binding sites for uranyl, located in the lipopolysaccharide (LPS) unit in the outer membrane of Gram-negative *Acidovorax facilis* cells. After the U(VI) sorption experiments, *Acidovorax facilis* cells were prepared for Energy-filtered transmission electron microscopy (EF-TEM) and electron energy-loss spectroscopy (EELS). The results support the TRLFS measurements by providing microscopically and spectroscopically evidence of U(VI) sorbed at the outer membrane of *Acidovorax facilis* cells by showing high electron density and U ionization intensity peaks. In addition, U was detected in the small polyphosphate granules of the cells, indicating the formation of a uranyl-phosphate complex as a result of an intracellular bioaccumulation process. However, EELS spectra indicate less U in the U-polyphosphate granules than in the outer membrane of the *Acidovorax facilis* cells.

[1] Barkleit, A., Moll, H. and Bernhard, G. (2008) *Dalton Transaction* 2879-2886.