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Spectroscopic and microscopic approach of U(VI) sorption on *Acidovorax facilis* for remediation purpose

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The Gram-negative betaproteobacterium *Acidovorax facilis* is a suitable candidate for *in situ* bioremediation of contaminated waste waters and environments [1]. For spectroscopic and microscopic studies kinetic U(VI) sorption experiments were performed under aerobic conditions at 30°C by adjusting an initial U(VI) concentration to 0.1 mM at a neutral pH range by adding $UO_2(NO_3)_2$ to the batch culture.

A high-resolution image of the cellular localization of U by *A. facilis* was achieved by using electron microscopy (STEM/HAADF). The elemental distribution analysis of phosphorus and uranium clearly indicates that U is entirely present in the cell membrane. By cryo-Time-resolved laser-induced fluorescence spectroscopy (cryo-TRLFS) studies the spectra deconvolution indicates a fast binding of U(VI) on phosphorylic functionality groups during the first hour with a subsequent formation of Uranyl-carboxylic species in addition to the Uranyl-phosphorylic species. Compared to emission spectra of the Uranyl-lipopolysaccharide [2] we suggest an interaction of UO_2^{2+} with cell membrane components of the outer membrane of *A. facilis* cells, whereas lipopolysaccharide will form the most stable complex. These results support those obtained by Extended X-ray absorption fine structure spectroscopy (EXAFS), where a relative short average U-O_{eq} bond length of 2.35 Å were observed for the U(VI) interaction with lipopolysaccharide indicating a binding of the U(VI) via organic phosphate groups in a monodentate fashion. The strong interaction of U(VI) with phosphorylic and carboxylic groups was reinforced by *in-situ* attenuated total reflection Fourier-transform (ATR FT-IR) spectroscopic studies due to the presence of characteristic phosphoryl vibrations. Most of the bound U(VI) presumably remained on the cells, more precisely on the phosphorylic functionalities at the cell membrane.

[1] Gerber et al. (2016). *J. Hazard. Mater.* 317, 127–134.
[2] Barkleit et al. (2008). *Appl. Spectrosc.* 62(7), 798-802.