



Removal and biotransformation of U(VI) and Cr(VI) by aerobically grown mixed microbial granules

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ABSTRACT

We assessed the potential of aerobic granular sludge consisting of mixed species of bacteria to remove and immobilize uranium (VI) and chromium (VI). Microbial granules were cultivated in a laboratory sequencing batch reactor (SBR) by feeding with acetate-containing synthetic media. Microbial granules formed in the SBR exhibited excellent settling characteristics and predominantly consisted of rod/cocci shaped bacteria. The microbial granules immobilized 218 ± 2 mg of U(VI) g^{-1} dry granular biomass. X-ray photoelectron spectroscopy (XPS) showed the association of U(VI) with the microbial granules and transformation of U(VI) to U(IV). Microbial granules reduced Cr(VI) and immobilized to Cr(III) at 0.17 mmoles/d/g under anaerobic conditions. X-ray absorption near edge spectroscopy (XANES) of chromium associated with microbial granules revealed complete conversion of Cr(VI) to Cr(III). Extended X-ray absorption fine structure (EXAFS) analysis of the Cr-laden microbial granules showed similarity to Cr(III)-phosphate. This study demonstrates the biotransformation and immobilization of U(VI) and Cr(VI) by mixed species microbial granules.

Keywords: Aerobic microbial granules; Aerobic granular sludge; Aerobic granules; Biosorption; Biotransformation; Bioremediation; Cr(VI) reduction; Uranium (VI)

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