

Selective removal of thorium and uranium for energy saving and removal of strontium, cobalt and cesium from the aqueous system using microorganisms

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Selective removal of thorium and uranium by various microorganisms from a solution containing both metals at pH 3.5 was examined. Among the tested species, a high removal ability for thorium was exhibited by strains of gram–positive bacteria, such as *Arthrobacter nicotianae*, *Bacillus megaterium*, *B. subtilis*, *Micrococcus luteus*, *Rhodococcus erythropolis*, and *Streptomyces levoris*. Though uranium was removed in small amounts by most of microorganisms, *A. nicotianae*, *S. flavoviridis* and *S. levoris* had relatively high uranium removal abilities. In these high performance thorium- and uranium- removable microorganisms, *S. levoris*, which removed the largest amount of uranium from the solution containing only uranium at pH 3.5, removed about 300 µmol thorium and 133 µmol uranium per gram dry weight. of microbial cells from a solution containing both thorium and uranium at pH 3.5. The amount and time course of the thorium removal were almost unaffected by the co-existing uranium, while those of uranium concentrations, and time course on both metal removal were also evaluated by numerical formulas.

Removal of cobalt, strontium and/or cesium ion from the aqueous solution using microorganism was also examined. *Arthrobacter nicotianae* was used for the removal of metal(s) in the solution. The removal of cobalt, strontium and/or cesium using *A. nicotianae* was affected by the solution pH, concentration of metal, and cell amount. The amount of metal ion(s) removed was increased with increasing the pH (1-5) of the solution. That (micromol metal ion/g dry wt. cells) was also inceased with increasing the concentration of the metal ion(s), however, the amount of total metal ion removed (%) was decreased. The amount of metal(s) removed (micromol metal ion/g dry wt. cells) was fitted with *Langmuir* isotherm. On the other hand, the amount of total metal ion removed (%) was increased with increasing the cell amounts, however, the amount of each metal ion removed (micromol metal ion/g dry wt. cells) was decreased. The amounts, however, the amount of each metal ion removed (micromol metal ion/g dry wt. cells) was decreased.

Keywords: Thorium removal; Uranium removal; Strontium removal; Cobalt removal; *Arthrobacter nicotianae*