**Advances in Environmental Research**, *Vol. 2*, *No. 3* (*2013*) *245-260*
DOI: http://dx.doi.org/10.12989/aer.2013.2.3.245 

# Biosorption of uranium by *Bacillus* sp.FB12 isolated from the vicinity of a power plant

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(*Received June 06*, *2013*, *Revised November 15*, *2013*, *Accepted November 16*, *2013*)

**Abstract.** Biosorption represents a technological innovation as well as a cost effective excellent remediation technology for cleaning up radionuclides from aqueous environment. In the present study, a bacteria strain FB12 with high adsorption rate of uranium ion was isolated from the vicinity of the nuclear power plant. It was tentatively identified as *Bacillus* sp.FB12 according to the 16S rDNA sequencing. Efforts were made to further improve the adsorption rate and genetic stability by UV irradiation and UV-LiCl cooperative mutagenesis. The improved strain named *Bacillus* sp.UV32 obtains excellent genetic stability and a high adsorption rate of 95.9%. The adsorption of uranium U (VI) by *Bacillus* sp.UV32 from aqueous solution was examined as a function of metal ion concentration, cell concentration, adsorption time, pH, temperature, and the presence of some foreign ions. The adsorption process of U (VI) was found to follow the pseudo-second-order kinetic equation. The adsorption isotherm study indicated that it preferably followed the Langmuir adsorption isotherm. The thermodynamic parameters values calculated clearly indicated that the adsorption process was feasible, spontaneous and endothermic in nature. These properties show that *Bacillus* sp.UV32 has potential application in the removal of uranium (VI) from the radioactive wastewater.

**Keywords:** uranium contamination; *Bacillus* sp.; mutagenesis; Biosorption; kinetic

## 1. Introduction

The depletion, deterioration and exhaustion of non-renewable energy have become serious bottlenecks constraining economic and social development. Development and use of nuclear energy is one solution to this problem because of its high density and low cost, but mining and processing of uranium mineral resources have also brought a large area of U pollution (Pollnann *et al*. 2006, Kryvoruchko and Antonina 2007). Additionally, depleted uranium (DU) weapons have been used in war frequently, leading to DU contaminated soil and water in combat areas (Li and Zhang 2012). Uranium, which exists commonly in $UO^{2+}$ form in waste water, has biologically dynamic toxicity, metabolism toxicity and chemical toxicity, leading to potential long-term harm to mammalian reproduction and development with reduced biological fertility, abnormal and slow embryonic development (Kalin *et al*. 2004, Domingo 2001). Toxicity is closely related to solubility, i.e., the more soluble the uranium compound is, the more toxic it becomes (Gavrilescu

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http://www.techno-press.org/?journal=aer&subpage=7 ISSN: 2234-1722 (Print), 2234-1730 (Online)

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