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*EXTENDED ABSTRACTS*

# Bioreduction of uranium using native Enterococcus faecalis and Lactococcus garvieae

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## ABSTRACT

The aim of this study is the isolation of the native bacteria from uranium mine with the potency of uranium removal in waste via reduction. The isolates is described as E. faecalis FJ4, L. garvieae FJ5, L. garvieae FJ6 and E. faecalis FJ7 seeing that Grampositive, cocci and facultative anaerobic bacteria. The isolates in the presence of U (VI) aqueous solutions led to formation of a black precipitate under anaerobic condition. ICP analysis of the solution in 2nd and 4th days of incubation indicated successful uranium removal of the solution. Moreover, analysis of the precipitate using UV-vis confirmed the reduction of U (VI) to U (IV). As a conclusion, the native isolates showed the ability of uranium removal from the contaminated wastes with uranium.

The diffusion of radionuclides from radionuclide contaminated sites and their mobility in the environment is a subject of public concern. Radioactive waste microbiology started with the understanding that bacteria could be present in disposal of waste and the effects of microbial activity could have deep influences on waste containment. Bacteria can potentially affect radionuclide migration using various processes. Bacteria decline radionuclide migration by reduction, sorption, altering bulk pore water chemistry, producing organic complexing ligands and by direct accumulation onto or into cells. Furthermore, bacteria can also cause corrosion and hence potentially affect the longevity of the metal waste containers in a repository.

Uranium as natural sources of radioactivity is present in earth's crust at concentration of 1.8 ppm. As explained above, bacterial reduction is an effective way for decline radionuclide migration (including uranium). This process is a microbial reaction between dissolved uranium, U (VI), and some kinds of bacteria in which electrons are transported from an electron donor to U (VI), as final electron accepter. Moreover, bioreduction is mediated by catalytic intermediary of reducing enzymes of bacteria that results in uranium reduction to the non-soluble form, U (IV).

The reduction of soluble U (VI) to insoluble U (IV) has been suggested as a device for inhibiting the migration of this toxic metal with ground water. Bacterial reduction of U (VI) is a suitable method that was first reported in crude extracts from Micrococcus lactilyticus by assaying the consumption of hydrogen which was dependent on the existence of U (VI). Nowadays more than 25 species of phylogenetically diverse prokaryotes are identified that be involved in the reduction of radionuclides. A number of these prokaryotes conserve energy from U (VI) reduction for their growth, and some of them reduce uranium without energy gain. Studies about bioreduction by TEM analysis indicated that the precipitated uraninite has been located in the periplasm and outside of Gram-negative and Grampositive bacterial cells. The research suggested that U (VI) complexes do not generally have access to intracellular enzymes. Microorganisms are able to precipitate metals and radionuclides as carbonates and hydroxides by localized alkalinization at the cell surface. On the other hand, metals can precipitate with enzymatically-generated ligands, e.g., phosphate, sulfide, oxalate, etc..

The aim of this study is the isolation and characterization of native bacteria with novel ability of uranium reduction from Bandar Abbas uranium mine, Iran. For this purpose, after isolation process, the ability of isolates for uranium removal from aqueous solutions was investigated and the mechanism of removal was studied using UV spectrums.

**Keywords:Isolation; *Characterization;*Enterococcus faecalis; Lactococcus garvieae; *Uranium reduction.***

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