RESEARCH PAPER:

Isolation of microbes from radionuclides and metal contaminated sub-surface soils for bioremediation of radioactive waste management

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Asian Journal of Environmental Science, (June, 2011) Vol. 6 No. 1 : 53-57

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SUMMARY

Radionuclides and metals have posed a great threat to the sustenance of life on this earth. These are released by various human activities and get accumulated without being eliminated. This environmental hazard can be alleviated by the utilization of metal assimilating microbes.The main objective of this study is to isolate microbes that help in the bioremediation of various metals and radionuclides from the sites of Indian Rare Earths Limited (IREL),Berhampur, Orissa, India.The isolated strains RIP-1 and RIP-2 *have* been shown to grow well in media supplemented with varied concentrations of different metals and exhibited maximum tolerance to UV radiations.

Praveen, B., Panda, Amrita, Das, Sisir and Bisht, S.P.S. (2011). Isolation of microbes from radionuclides and metal contaminated sub-surface soils for bioremediation of radioactive waste management . *Asian J. Environ. Sci*., **6**(1): 53-57.

Key words :
Radio nuclides, Bioremediation, IREL, Radiations

In India, rare-earth compounds are produced from the beach sand mineral monazite. Caustic digestion of the mineral followed by selective acid extraction is the method used to separate composite rare-earth fraction. The composite rare-earth chloride contains low levels of natural radionuclide and is the starting material for individual rare-earth compounds which have wide applications.

One major research effort focuses on the stabilization of metal contaminants, such as uranium and chromium, through *in situ* stimulation of natural microbial communities to reduce the metals to less soluble forms. These communities in the subsurface have the capacity to immobilize several metal contaminants but are often limited by the lack of suitable electron donors. As electron donors (*e.g.*, methanol, ethanol, pyruvate, glucose) are added, oxygen is consumed through aerobic respiration. Then, alternate electron acceptors are used by bacteria, typically in a sequence determined by community metabolic potential, electron donor bioavailability, and decreasing energy yield of reaction. Oxidized soluble metals, such as U(VI) and Cr(VI), may be transformed to reduced, insoluble forms through various metabolic and coupled biogeochemical processes.

Previous studies, summarized in (Suzuki and Suko 2006) and (Wall and Krumholz 2006), have shown that although uranium bioremediation through subsurface electron donor addition is possible, significant challenges persist e.g electron donors shown to stimulate aqueous uranium reduction upto 51% or less sediment-bound uranium (Ortiz-Bernad *et al*., 2004 and Wu *et al*., 2006). Often, the electron donor is chosen to target organisms known to rapidly reduce uranium in laboratory settings. Nonlinear relationships between microbial community structure and subsurface biogeochemistry have been demonstrated for immobilization of metals (Palumbo *et al*., 2004), suggesting that, although enrichment of specific target organisms has been documented in field experiments (Holmes *et al*., 2002; Nevin *et al*., 2003; Anderson *et al*., 2003; Istok *et al*., 2004, North *et al.,* 2004; Chang *et al*., 2005; Wu *et al*., 2006), the prevalence of individual taxonomic groups may not be sufficient to describe the potential for long-term uranium immobilization. Sorbed or mineral forms may continue to release uranium to

Received:
February, 2011
Accepted :
April, 2011