EXTRACTION OF SOME ECONOMIC ELEMENTS FROM SEDIMENTS, SOUTH SINAI USING PHYTO AND BIOMINING

Submitted By

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B.Sc. of Agriculture, Faculty of Agriculture, Ain Shams University, 1997
Diploma of Environmental Sciences, Institute of Environmental Studies & Research, Ain Shams University, 2006

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Science

Department of Environmental Agricultural Science
Institute of Environmental Studies and Research
Ain Shams University

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Naglaa Abd El Kader Ali El Said

ABSTRACT

Um Bogma area, southwestern Sinai, was considered as one of the most polluted area in Egypt, where its deposits and soil are highly enriched in metals, especially Pb, Zn, Cd, Cu, Co, REEs and U. Due to the environmental implications and the economic importance of most of them, the remediation of soil, extraction of these metals and recovery of some metals are the main target. So, the present work highlights this area through two low cost techniques, namely; Phytomining and biomining. Sunflower and kenaf are the selected hyperaccumulator plants, while the isolated *Aspergillus niger* and *Aspergillus flavus* fungi species and Bacillus subtills bacteria species are the organisms used in this study. From the phyto-treatments and their statistical analysis, it can be found that the decrease in dry weight of the two plants grown in Um Bogma soil may be due to adverse effect of metals that involve actions on several metabolic processes in the plant. The fresh weight of roots stems and leaves of plant at different time with addition of EDTA were less than control plant (untreated plants). EDTA is a well chelating agent increases the activity of the metals in the soil solution, and then enhanced the metal bio-availability and subsequent uptake and translocation in organs of sunflower and kenaf plants. These hyperaccumulators were characterized by low biomass and slow rate of growth. The recorded fungi species show higher bioleaching and biosorption capacities than that recorded by bacteria.

The bioleaching and biosorption processes of U, heavy metals and REEs from Um Bogma ore material were carried out using both *Aspergillus niger* and *Aspergillus flavus* fungi and Bacillus subtills bacteria species that isolated from the sample ore under investigation. The effective bioleaching of these metals occurred at incubation time of 4 days, solid/liquid (S/L) ratio of 1/5 and temperature of (60ºC). The maximum biosorption capacities of metals occurred at ore concentration 4% pH 6, 3days culture age respectively Environmental Scan Electron Microscope (ESEM) shows high accumulation of U and REEs (Ce, Nd and La) on cell wall surface of *Aspergillus niger* and *Aspergillus flavus.* Also, the chemical analysis of these accumulated ions revealed that, *A.flavus* has relative high biosorption capacity for uranium and REEs.

The recorded gram positive oxidizing bacteria (*Bacillus subtills*) *as* well as the oxidizing *Aspergillus niger* and *Aspergillus flavus* are known for their ability to form a broad spectrum of organic acids such as oxalic acid, acetic acid, desferrioxamine siderophore and non-acidic biomolecules mainly phosphatase enzyme. Under these

acidic conditions and the microbial activity, the primary minerals from the soil would dissolve releasing these chemical elements. These microorganisms are capable to removing the radioactive elements and heavy metals from the studied soil by the physico-chemical interactions during the adsorption processes depending upon cell metabolism.

Key Words: Um Bogma area- -Bioremediation- phytotechnology Phytoremediation-Hyperaccumulator plants-Snflower-Kenaf – Chleating agents –Bioleaching-*A.niger*-*Aflavus.* -Biosorption

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