BIOREMEDIATION OF CHROMIUM BY USING Aspergillus niger AND Pseudomonas aeruginosa

R. Sathya, and P. Sankar*

Abstract

In general, heavy metals are systemic toxins with specific neurotoxic, nephrotoxic and phototoxic effects. Heavy metals can directly influence behaviour by impairing mental and neurological function, influencing neurotransmitter production and utilization and altering numerous metabolic processes. As with any other cleanup technology, the success of bioremediation can be evaluated by the rate and extent of pollutant removal attained, by the long term sustainability and by the regulatory compliance of the methodology. In this present study, Aspergillus niger and Pseudomonas aeruginosa were identified and inoculated with chromium to analyse the capability of those microorganism in bioremediation. The results revealed that chromium level decreased in culture media. It was also observed that Aspergillus niger removes the chromium at higher rate when compared to that of Pseudomonas aeruginosa.

Key words: Heavy metal, chromium, bioremediation, Aspergillus niger, Pseudomonas aeruginosa,

INTRODUCTION

Pollution is an undesirable change in the physical, chemical and biological characteristics of environment. At the beginning of this century the order of civilization of a nation was being measured by the per capita consumption of soap in the nation. It is tragic that at the close of 20th century, the order of civilization is measured by the amount of pollutants released into the environment. Bioremediation is an ecological system to cope pollution problems. Bioremediation is an ecologically sound and state-of-the-art technique to deal with contaminants.

Bioremediation is the process of using bacteria and other biological enhancements under controlled conditions to control pollution (EI Fantroussi and Agathos, 2005).

Effects of Chromium On The Environment

Chromium is used in metal alloys and pigments for paints, cement, paper, rubber, and other materials. Low-level exposure can irritate the skin and cause ulceration. Long term exposure can cause kidney and liver damage to circulatory and nervous system. Chromium often accumulates in aquatic life, adding to the danger of eating fish that may have been exposed to high levels of chromium. (Li et al., 2006)

Luli et al., (1983) reported the reduction of hexavalent chromium to trivalent chromium, which then can be precipitated to chromium oxides, sulphides or phosphates. Mercury is also one another example for heavy metals to be precipitated.

Sabry et al., 1997, Wasay et al., 1998, Chande et al., 2002, Park et al., 2004, Ahmad et al., 2006 were studied works on bioremediation of chromium metal. They have noticed that some microorganisms were resistant to
chromium. The majority of the tested strains were multiple metals resistant.

The first aim of the present study was removal of chromium using microorganisms. The second aim was to identify the microorganisms and isolate them. The third aim was to study the removal of chromium by microorganisms from the medium.

MATERIALS AND METHODS
Collection of Soil Sample
Soil samples were collected from different sites at random from petrol bunk. The collection of samples was made at a depth with in 15 cm from the surface of the soil. The collected samples were brought to the laboratory in sterilized polythene bag, air dried and stored in a container for future use.

In this work two organisms are taken. A fungal organism, Aspergillus niger and a bacterial organism Pseudomonas aeruginosa and identification of organism were done.

Isolation of Aspergillus niger from Soil
Serial dilution agar plate method was carried out to isolate the Aspergillus niger. About 10 gram of soil sample was suspended in 100 ml of distilled water to make a microbial suspension. Serial dilutions $10^{-2}$, $10^{-3}$, $10^{-4}$ and $10^{-5}$ were made by pipetting required amount of sterile water. Using pour plate technique plate 1ml of the diluted soil suspension in sterile Petri plates containing fungal medium supplemented with streptomycin 10 mg/l. The plates were incubated in an inverted position for 3-7 days at 25°C.

Identification of Aspergillus niger
Identification was performed by the wet mount technique. A drop of lacto phenol cotton blue was placed on a clean glass slide. A small tuft of fungus, with spores and spore bearing structures, was transferred into the drop, using a flamed, cooled needle. The stain was mixed with the mold structures. A cover slip was placed over the preparation carefully to avoid air bubbles. The preparation was examined under low-power and high power objectives.

Culture Maintenance
The Aspergillus niger culture from potato dextrose broth was streaked on a Rose Bengal agar slant and it was incubated at 27°C for 72 hours. It was then sub cultured and was stored in refrigerator for further use.

Isolation of Bacteria from Soil
10 gm sample of finely pulverized, air dried soil was suspended in 90 ml of sterile water blank to make 1:10 dilution ($10^{-1}$).Serial dilutions, $10^{-4}$ .... $10^{-7}$ was made, by pipetting 1 ml in to additional dilution blanks (having 9 ml of sterile water).Finally 1 ml aliquot of $10^{-4}$ to $10^{-7}$ dilutions were added to sterile Petri dishes, to which are added 15ml of the sterilized (121°C,at 15lbs for 15 minutes),cooled, molten(45°C) Nutrient agar media. After solidification, the plates were incubated, in an inverted position for 12-24 hours at 37°C.

Identification of Pseudomonas aeruginosa
The centrimide agar plate has variety of colonies. The selected bacterial colonies were identified by the microscopic and Biochemical analysis. The pure culture
was streaked on the centrimide agar medium.

**Removal of Chromium**

*Aspergillus niger* was inoculated in two flasks with 0.5 gm and 1.0 gm chromium content separately. The removal of chromium was reduced from the decreasing optical density values.

*Pseudomonas aeruginosa* was inoculated in two flasks with 0.5 gm and 1.0 gm chromium content separately. The removal of chromium was deduced from the decreasing optical density values. When compared to *Aspergillus niger* the efficiency of chromium removal is lesser in *Pseudomonas aeruginosa* inoculated medium.

### RESULTS AND DISCUSSION

Bacteria was isolated and identified by colony characteristics, staining and biochemical reactions. Fungi was identified by wet mount technique unbranched nonseptae vertical hyphae was observed under the microscope conforming *Aspergillus niger*.

*Aspergillus niger* was inoculated in two flasks with 0.5 gm and 1.0 gm chromium content separately. The removal of chromium was deduced from the decreasing optical density values.

*Pseudomonas aeruginosa* was inoculated in two flasks with 0.5 gm and 1.0 gm chromium content separately. The removal of chromium was deduced from the decreasing optical density values.

When compared to *Aspergillus niger* the efficiency of chromium removal is lesser in *Pseudomonas aeruginosa* inoculated medium.

### Table 1- Removal of Chromium using *Aspergillus niger*

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### Table 2- Removal of Chromium using *Pseudomonas aeruginosa*

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CONCLUSION

In this present study removal of chromium was investigated using Aspergillus niger and Pseudomonas aeruginosa. The results revealed that chromium levels decreased in culture media of Aspergillus niger removes the chromium at higher rate when compared to that of Pseudomonas aeruginosa.

REFERENCE