IJREB

ISSN 2321-743X

International Journal of Research in

Engineering and Bioscience

Volume 2 Issue 6 (Pages218- 222)

Journal home page: www.ijreb.org

IMPORTANCE OF OVERHEAD PRODUCTION OF HEXAVALENT CHROMIUM COMPOUNDS AND CONTROL MEASURES OF ECOSYSTEM IMBALANCE BY USING PHYTOREMEDIATION

K. Karthik and P.S. Sharavanan

Department of Botany, Annamalai University, Annamalai Nagar, Tamil Nadu

ABSTRACT

Chromium (VI) compounds are mostly lemon-yellow to orange to dark red in colour. They are typically solid (i.e. crystalline, granular, or powdery) Chromium (VI), also known as hexavalent chromium, is the second most stable oxidation state of chromium. Rarely occurring naturally in Cr III, most chromium (VI) compounds are manufactured (products or by-products). Chromium (VI) can be reduced to the more stable chromium (III) in the presence of reducing agents (e.g. iron) Chromium (VI) compounds are used widely in various applications that include: pigment for textile dyes as well as for paints, inks, and plastics, corrosion inhibitors, wood preservatives (chromium trioxide); metal finishing and chrome plating (chromium trioxide, strontium chromate), and leather tanning (ammonium dichromate). The effects of Cr VI compounds wastes are primarily emitted to the industrial processes through environment as a result of anthropogenic activities and its effects caused the soil ecosystem imbalance or ecosystem damage. The phytoremediation processes of using plants for polluted land, functioning as a control mechanism for heavy metal pollution. These points of view present study shows applications and control measures of hexavalent chromium pollution using phytoremediation technology.

KEYWORDS: Hexavalent chromium, Chromium (III), Anthropogenic activity, Human carcinogen, Ecosystem imbalance.

INTRODUCTION

Soil ecosystems throughout the world have been contaminated with heavy metals by various human activities, and movement of metals up the food chain has become a human health hazard (Naidu et al., 1996). The Heavy metals are the main group of inorganic contaminants and a considerable large area of land is contaminated with them due to use of sludge or municipal compost, pesticides, fertilizers, and emissions from municipal waste incinerators, car exhausts, residues from metalliferous mines, smelting industries and tannery industries(Das et.al.,1997) And workers in many different occupations are exposed to hexavalent chromium (Chromium (VI)) and its increas-ing the risk of developing serious adverse health effects. Occupational exposures occur mainly among workers who handle pigments containing dry chromate and spray paints and coatings containing chromate; operate chrome plating baths; and weld or cut metals containing chromium, such as stainless steel. The stainless steel, tannery industries and welding involves the greatest exposure to Chromium (VI). The plants are mainly focused on here to control heavy metal pollution for absorb metals from soil and sediments through their root/rhizome system which is a common phenomenon of phytoremediation. Phytoremediation is an effective, low cost, preferred cleanup option for moderately contaminated areas.

INDUSTRIAL IMPORTANCE

The chromium vi compounds(Cr VI) are industrially manufactured overhead production of products or by-products of textile dyes, corrosion inhibitors, wood preservatives, and leather tanning products such as Shoes - Sport material, Bags- Toys, Snow boots, Car seats –Sofa ect…(OSHA-2006).

S.No	Uses	Chromium (VI) chemicals
1	Pigments for paints, inks, plastics	Lead chromate, Zinc chromate, Barium chromate, Potassium chromate.
2	Anti-corrosion coatings	Chromic trioxide (chromic acid), zinc chromate, barium chromate, calcium chromate, sodium chromate, strontium chromate.
3	Stainless steel	Chromium (VI) is given off when stainless steel is cast, welded, or plasma torch cut
4	Textile dyes	Ammonium dichromate, potassium chromate, sodium chromate
5	Wood preservatives	Chromium trioxide
6	Leather tanning	Ammonium dichromate

HEALTH EFFECTS

Cancer

The chromium (VI) compounds as encountered in the chromate production, tannery, pigment and chromium plating industries, IARC categories“ group I carcinogen” (IARC 1990.) The IARC reviewed studies of workers in those industries and compounds were reaffirmed as an IARC-group 1 carcinogen.(Straif et.al., 2009; IARC2012).

Air born exposures

The Cr (VI) is formed as a by-product include those utilizing metals containing metallic chromium including welding, thermal cutting of metals, steel mills and iron and steel foundries. In welding process metals are heated to the melting point, and a fraction of the melted metal that escapes the welding – arc area quickly condenses and oxidizes into welding fume and an appreciable fraction of the chromium in this form of Cr(VI) (Fiore 2006, Heung et al.2007)

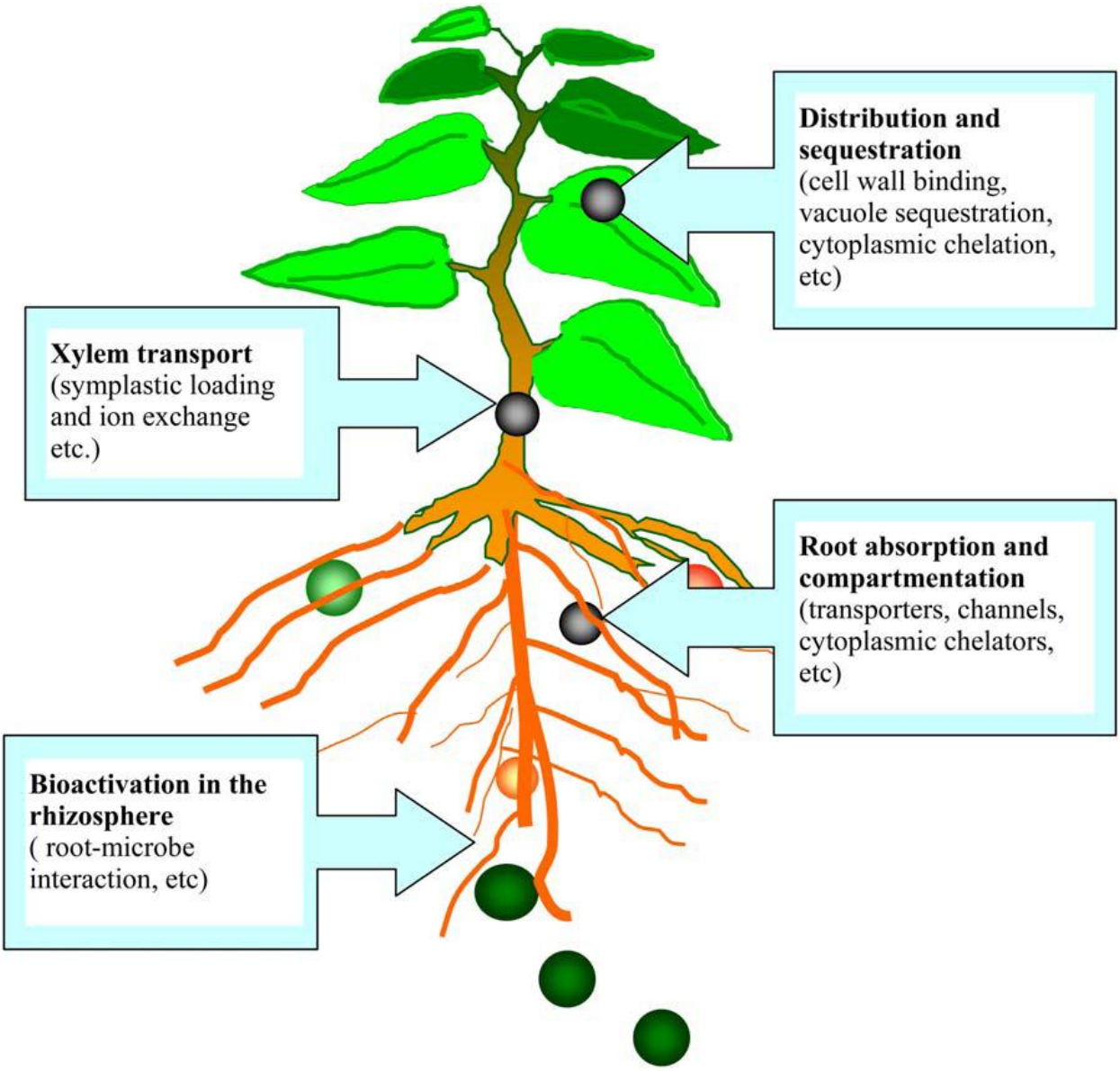
Dermal exposures

The many other industries are at risk of dermal exposure if there is any splashing, spilling or other skin contact with material containing Cr^{6+}. In welding, steel, tannery and other industries with reported dermal exposure include chromate production (Gibbe et.al.,2000a); electroplating (Makinen and Linnnainmaa 2004a).

Phytoremediation

Phytoremediation is defined as the use of plants to remove pollutants from the environment or to render them harmless (Salt et al., 1998). Five main subgroups of phytoremediation have been identified:

- Phytoextraction: plants remove metals from the soil and concentrate them in the harvestable parts of plants (Kumar et al., 1995).
- Phytodegradation: plants and associated micjrobes degrade organic pollutants (Burken and Schnoor, 1997).
- Rhizofiltration: plant roots absorb metals from waste streams (Dushenkov et al., 1995).
- Phytostabilisation: plants reduce the mobility and bioavailability of pollutants in the environment either by immobilization or by prevention of migration (Vangronsveld et al., 1995).
- Phytovolatilisation: volatilization of pollutants into the atmosphere via plants (Burken and Schnoor, 1999.



Mechanism of Phytoremediation

CONCLUSION

The threat of heavy metals to human and animal health is aggravated by their long-term persistence in the environment. But the present strategy of industrialization is grown among the globe and developed economically for the production of various kinds of industrial products. At the same time lose our soil ecosystem for the overhead production of heavy metal such as chromium vi compounds and usage of synthetic industrial products. And hexavalent chromium compounds are creates health effects of human being as well as plants and animals development. The present study of review was concluded that mechanism of phytoremediation technology and its applications are suitable for control the heavy metal pollution from the soil.

REFERENCES

Burken JG, Schnoor JL. Distribution and volatilisation of organic compounds

following uptake by hybrid poplar trees. Int J Phytoremediat 1999;1:139– 51.

Das P, Samantaray S, Rout GR. Studies on cadmium toxicity in plants: a review. Environ Pollut 1997;98: 29–36.

Dushenkov V, Kumar PBAN, Motto H, Raskin I. Rhizofiltration: the use of plants to remove heavy metals from aqueous streams. Environ Sci Technol 1995;29:1239–45.

Fiore S [2006]. Reducing exposure to hexavalent chromium in welding fumes. Welding Journal 85(8):38–42.

Gibb HJ, Lees PS, Pinsky PF, Rooney BC [2000a]. Clinical findings of irritation among chromium chemical production workers. Am J Ind Med 38(2):127–131.

IARC [2012]. IARC monographs on the evaluation of the carcinogenic risks to humans: a review of human carcinogens: arsenic, metals, fibres, and dusts. Vol. 100C. Lyon, France:World Health Organization, International Agency for Research on Cancer, pp. 147–168.

Kumar PBAN, Dushenkov V, Motto H, Rasakin I. Phytoextraction: the use of plants to remove heavy metals from soils. Environ Sci Technol 1995;29:1232– 8.

Naidu R, Kookuna RS, Oliver DP, Rogers S, McLaughlin MJ. Contaminants and the soil environment in the Australasia-Pacific Region Dordrecht: Kluwer Academic Publishing, 1996.

OSHA; Occupational Safety and Health Administration. Department of Labor (2006).

Salt DE, Smith RD, Raskin I. Phytoremediation. Annu Rev Plant Physiol 1998;49:643–68.

Vangronsveld J, van Assche F, Clijsters H. Reclamation of a bare industrial area contaminated by non-ferrous metals: in situ metal immobilization and revegetation. Environ Pollut 1995;87:51 – 9.