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Jearmeen SM* and Sam Manohar Das S

Department of PG studies and Research Centre in Zoology, Scott Christian College (Autonomous), Nagercoil 629 003, Tamil Nadu, India

Abstract

Contamination of soils, ground water, sediments, surface waters and air with trace metals is one of the major environmental problems. Owing of this study focused on the investigation of the capability of the dried biomass of Phaseolus mungo / WR UHPRYH KHDY\ PHWDO FKURPLXP IURP WLWDQLXP LQGXVWU FRQ¿UPHG WKDW P.mungo FDQ EH HIIHFWLYHO\ XVHG IRU WKH WUHDWPHQW RI KHDY

Keywords: Seeds of Phaseolus mungo; Titanium industry waste; Red soil; Sand and vermi compost.

Introduction

Soils may become polluted with high concentration of toxic metals and their remediation requires excavation and removal of soils to secured land lls, an expensive technology that requires sites restoration involving secondary environmental and legal problems. But phytoremediation of heavy metal contaminated soil basically involves the extraction or inactivation of metals in soils [1].

Plants known as hyper-accumulators have been shown to accumulate hundred or thousand times more metals than normal plants [2]. Plants uptake of pollutants from water is one of the pathways considered in models aimed at assessing the hazard of chemical contaminants in water [3].

Sun ower is reported to have high metal accumulating ability, yet low Cr tolerance compared to other agronomic crops. It is known that Cr predominantly exists in two forms in soil; as a trivalent cation and divalent dichromate anion . Cr(III) readily precipitated in soil, whereas greater environmental pollution problems occurred with the more mobile and toxic Cr(vi) [4,5].

Roots uptake metals through the main root with subsequent translocation to above ground tissues [6,7]. Aquatic plants play an important role as a transportation link for metals from the sediments up to shoots. Only a fraction of the metals absorbed is transferred from the roots to the above ground parts [8,9].

e chemical modi cation and spectroscopic studies have showed that the cellular components included carboxyl, hydroxyl, sulfate, phosphate, amino, amide, imine and imidazole moieties which have metal binding properties and are therefore, the functional groups in these plants [10].

is study is designed to check whether commercially important pulse could remediate metal contamination of soils by titanium industry wastes.

Materials and Methods

Collection of solid waste

Solid wastes were collected from Titanium factory and stored in plastic bags. e solid wastes are deposited along the passage way of e uents discharged from the titanium factory. e solid wastes comprise of materials precipitated from the liquid e uent.

Neutralizing solid waste

About 200 g of lime (calcium oxide) were added to 1 kg of titanium solid waste and mixed well. e pH was checked using a pH meter (ELICO LI 120) and adjusted to 7 (neutral). If the pH is less than 7.0, lime is added and if high, little quantity of solid waste was added.

Experimental design

i. Preparation of solid waste-amendments

a. Neutralized solid waste and amendments were mixed in 1:1 proportion. e ratio of the mixture was 1 Kg solid waste, 0.5 Kg red soil, 0.25 Kg sand and 0.25 Kg vermin compost. e ingredients were mixed well and the pH was checked.

b. Solid waste-amendments mixture was prepared in 2:1 ratio by mixing 4 Kg neutralized solid waste with amendments such as 1 Kg soil, 0.5 Kg sand and 0.5 Kg vermin compost.

c. 3:1 mixture of solid waste-amendments mixture was obtained by adding 6 Kg neutralized titanium solid waste to amendments such as 2 Kg soil, 1 Kg sand and 1 Kg vermin compost.

Phytoremediation studies

d. Phytoremediation of Titanium industry e uent was carried out with Phaseolus mungo (L.) plant. is commercially important crop was grown extensively in India. e use of a commercially important plant in bioremediation carries dual bene ts of grain production as well as toxicity alleviation.

Culture of P. mungo

e. Earthern pots were used as the culture vessels. e pots were lled with solid waste-amendment mixtures (1:1, 2:1 and 3:1 ratios). en P. mungo seeds were sown in the soil mixture in each pot. Twenty

*Corresponding author: Department of PG studies and Research Centre in Zoology, Scott Christian College (Autonomous), Nagercoil 629 003, Tamil Nadu, India. Tel: 04652-231807; E-mail: jearmeen25@gmail.com

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up. Eventhough the di erent phytal parts accumulated metals , the grains or the edible parts rarely accumulated them, thus remaining non-toxic to human consumers. Torresdey et al [11] found that Cr being concentrated in the roots and not translocated to the aerial parts of the plant by determining the uptake and accumulation of Cr by Convolvulus arvensis (L.). e roots, stems and leaves of P. mungo accumulated metal found in the titanium industry e uent. e mobilization of these metals was recorded a er 30 and 60 days of growth in the waste-amendments mixture.

Chromium very e ectively bioaccumulated in the phytal parts of plants. Roots accumulated more chromium than stems and leaves and the accumulation was maximum on the 60th day. e individual metal concentrations in living tissues are generally low and must be maintained within narrow limits to secure optimum biological performances. Chromium as well as other metals are absorbed by root and shoot systems and may be stored and mobilized according to