How Phytore Mediation Technology Protecting Soil, Water & Environment from Heavy Metal Stress

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ABSTRACT
Heavy metals like Pb, Cd, Cr, As, Cu are a serious threat for plants, animals, food chain and living beings causes illness or damage to human beings, animals and plants ,water becomes unfit for drinking, changing PH of Soil and water. Phytore mediation technology is the use of green plants and Hyper accumulator's to clean soil, water, air and environment. Hyper accumulator's like Lycopersicon esculentum (Tomato), Brassica juncea (Mustard), Helianthus annus (Sunflower), Eicchornea crassipes(Water Hyacinth) clean soil and water when grown in it. The mechanism involved in Phytore mediation technology is Phytoextraction Phyto accumulation, Phytostabilization by reducing mobility, Rhizofiltration, Phytode gradation, Reduction in root, shoot length and TF=^1,BCF^1shows heavy metal transferred from root, shoot and potential of Phytore mediator plants for Phytore mediation.

I INTRODUCTION

Phytore mediation is the use of green plants to remediate the contaminants present in soil, water, air, land etc. Phytore mediation Greek words Phyto means "plant", and remediation means" recovery, "removal" .Hyper accumulators like Lycopersiconesculentum (Tomato), Brassicajuncea (Mustard), Helianthusannus (Sunflower), Eicchorneacrassipes (Water Hyacinth) clean soil and water when grown in it. When heavy metals enter the soil and water sequestration or reduction of heavy metals takes place in rhizosphere through roots and xylem vessels in shoots by metal complextion, precipitation etc. concentration of heavy metals decreases and soil, water becomes free from heavy metal. Reduction in root, shoot length is observed when heavy metal transfer takes place from soil to aerial parts of plant for removal of heavy metals. Phytoremediation technology checks soil erosion. The translocation factor TF greater than one and BCF greater than one is found which shows greater potential for Phytoremediation. In this way Phytoremediation technology clean soil, water, air and environment.

II LITERATURE REVIEW

Phytoremediation is the use of green plants to remediate the contaminants present in soil water, air, land etc. Checks soil erosion in soil, water, air, land etc. Phytoremediation Greek words Phyto means "plant", and remediation means" recovery" or "removal". With the development of industrialization and urbanization, the abundance of heavy metals in the environment has increased enormously during the past decades, which raised significant concerns throughout the world (1).(1-7). Heavy metals are a group of metallic chemical elements that have relatively high densities, atomic weights, and atomic numbers. The common heavy metals/metalloids include cadmium (Cd), mercury (Hg), lead (Pb), (Cd), mercury (Hg), lead (Pb), arsenic (As), zinc (Zn), copper (Cu), nickel (Ni), and chromium (Cr). These heavy metals/metalloids originate from either natural or anthropogenic sources such as produced water generated in oil and gas industries (Neff et al., 2011; Pichtel, 2016), use of phosphate fertilizers in agriculture (Hamzah et al., 2016; Rafique and Tariq, 2016), sewage sludge (Farahat and Linderholm, 2015), metal mining and smelting (Chen et al., 2016), pesticide application (Iqbal et al., 2016), electroplating, and fossil fuel burning (Muradoglu et al., 2015).Phytoremediation is the use of plants and associated soil microbes to reduce the concentrations of contaminants in the environments. It is a relatively recent technology and is perceived as cost effective, efficient, novel, eco-friendly and solar driven technology with good public acceptance. Phytoremediation is an area of active current research. New efficient metal hyper accumulator's are being explored for applications in phytoremediation and phytomining-. Molecular tools are being used to better understand the mechanisms of metal uptake, translocation , sequestration and tolerance in plants.

Phytoremediation a green technology consists of process phytoextraction, phytostabilization, phy-Phytodegradation, Phytovolatalization, Rhizofiltration, Phytostabilization(1).With increasing industrialization mining, pesticides sewage disposal, heavy metal deposition and other contaminants are added in water and soil through human activities. These interfere with the metabolic functions of plants, in hibition photosynthesis, respiration, cropyield, sometimes intracellular compartments of cell. Mining include crushing, grinding, washing, smelting. (Subodh kumar Maiti)(2010). Phytoremediation is a group of technologies that use plants to reduce degrade or immobilized environmental toxins. Phyto extractions also known as phytoaccumulation, phytoabsorption, and Phytose quest ration (7).This process reduces soil metal concentration by cultivating plants with a high capacity for metal accumulation in shoots. Plants extract large concentrations of heavy metals into their roots, trans locate the heavy metals to above ground shoots or leaves and produce large quantity of plant biomass that can easily be harvested. Rhizofiltration technique is used in cleaning contaminated waste water or contaminated waste water or acid mine drainage by absorption or precipitation. Phytostabilization is phytoimmobilization, holding of contaminated soil and sediments in place of vegetation and to immobilized toxic contaminants in soils. It occurs through the sorption, precipitation, complexation or metal valence reduction. For eggrasses, sedges, forage and reeds. Phytovolatalization involves the use of plants to take up contaminants from the soil transforming them into volatile form and transporting them into the atmosphere.eg selenium. Phytodegradation also known as Phyto trans formation, involves uptake, metabolization degradation of contaminants within the plant or in the soil sediments, sludges, groundwater or surface water by enzymes produced and released by the plant.(Hazrat Ali a*,Ezzat Khan et al(2013). Heavy metals refers to any metallic chemical element that has relatively high density and is toxic or poisonous at low concentrations eg of heavy metals like Cadmium (Cd), Chromium (Cr), Lead (Pb), Arsenic (As),Ti etc. Heavy metals are naturally found in earth. They are used in Many modern day applications such as agriculture, medicine, industries etc. Heavy metals when dumped by anthropogenic activities in soil through food chain affect the plants animals and human beings.

Phytoremediator Plants-Lycopersicon esculentum (Tomato), Brassica juncea (Mustard), Helianthus annus(Sunflower), Eicchornea crassipes(Water hyacinth).

TF greater than one, BCF greater than 1 suggest heavy metal transfer from root to shoot and to roots and shoots with maximum Phytoremediation.

III OBJECTIVES & HYPOTHESIS

(a) Objectives- To study how Phytoremediator technology is cleaning soil and water and checks soil erosion maintaining pH of soil. To study the processes and mechanism of cleaning the soil, water and environment. To prevent soil, water and environment by this technology. To study TF and BCF for remediation of heavy metals from soil and water.

(b) Hypothesis - Phytoremediation processes clean soil and water by shortening root, shoot length, increase in biomass of root means heavy metal is transferred to root and shoot and remediation is taking place. TF greater than one, BCF greater than 1 suggest heavy metal transfer from root to shoot and to roots and shoots with maximum Phytoremediation processes and greater remediation of heavy metals from soil and water , checking soil erosion and greater Phytoextraction capacity of Phytoremediator's.

IV EXPERIMENTAL STUDY

(a) Methodology-Plants of Lycopersicon esculentum ie Tomato, Helianthus annus, Eicchornea crassipes, Brassica juncea grown in pots and water pots,pots are treated with heavy metals of different concentrations. Root, shoot lengths is observed. Root, shoot is washed and solution is observed in atomic absorption Spectrophotometer (AAS). Future prospects- Phytoremediation is a cost effective technology and has wide applications. The process is helpful in cleaning of environment. Transgenic plants are helpful in technology and helpful in near future.

(b) Application- Helpful in cleaning soil, water, air, land and also remediation of heavy metals and other contaminants.

V RESULTS AND DISCUSSION

Results are tabulated at Table 1 and shown in Fig. 1 to increase in root biomass suggest that heavy metal transferred to root, TF greater than one, BCF greater than one suggest that heavy metal transferred to aerial parts of plant. Decrease in root, shoot length suggest that heavy metal transferred with greater Phytoremediation.

VI CONCLUSION

Phytoremediation processes clean soil and water by shortening root, shoot length, increase in biomass of root means heavy metal is transferred to root and shoot and remediation is taking place. TF greater than one, BCF greater than 1 suggest heavy metal transfer from root to shoot and to roots and shoots with maximum Phytoremediation processes and greater remediation of heavy metals from soil and water , checking soil erosion and greater Phytoextraction capacity of Phytoremediator's.

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Table 1

Table of conc,TF,bcf biomass etc. 25mg/kg Cr ,Cd conc. Root 10 mg,100mg Cd conc.	TF=1.61,1.43 18.78,175ug/g
Solanum Lycopersicon Shoot length-control 30.7 at 150mg lead 20.7 Root length control-14.3,10.3 at 150 mg lead. Root biomass at 10ug Cd conc	BCF-1.2,TF-2.1 Control1.4, increases to 1.5
Helianthus annus 20 mg Cd conc. BCF-1.8	BCF-1.8
Eicchornea crassipes 10mg CdCl2	Shoot conc-986 Root conc-956ug/g dry wt TF-1.03 TF =1.03

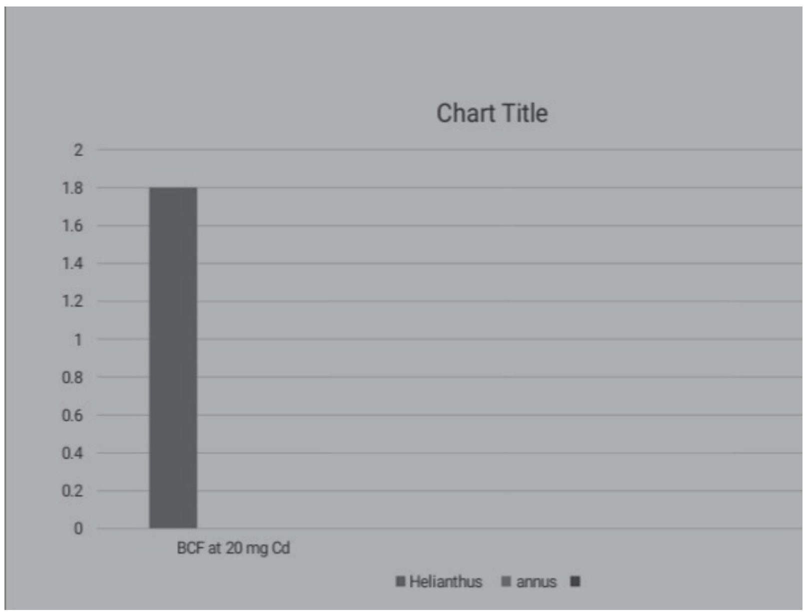

Fig. 1 Graphs BCF of Helianthus Annus

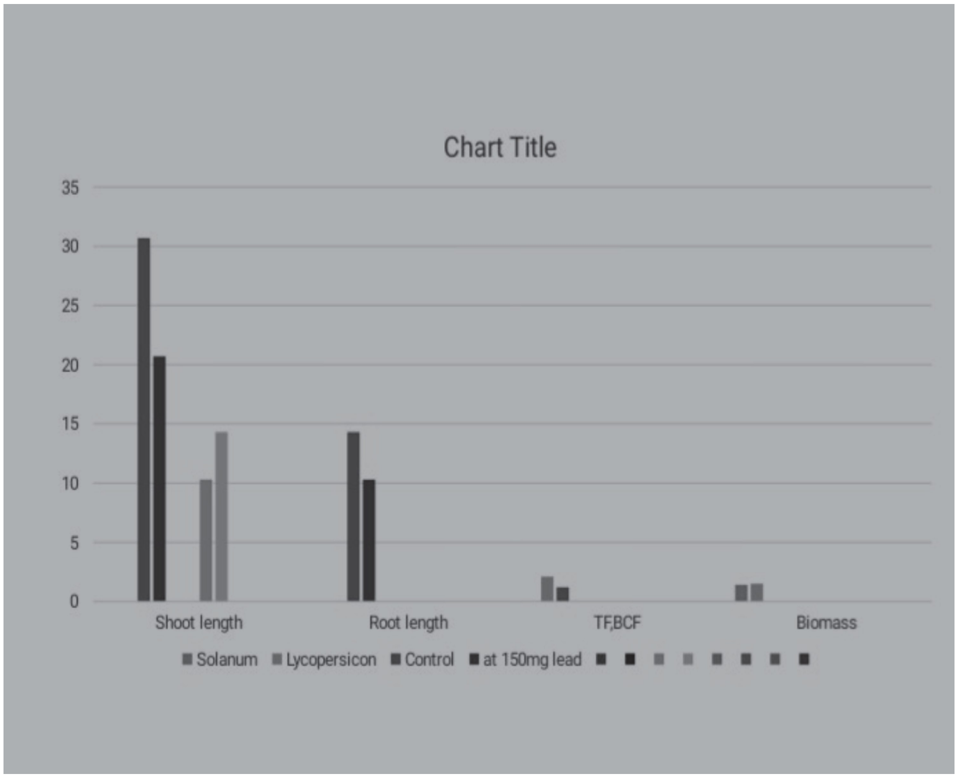

Fig. 2 Shoot length,Root length,TF,BCF, Biomass of Solanum Lycopersicon (Tomato).

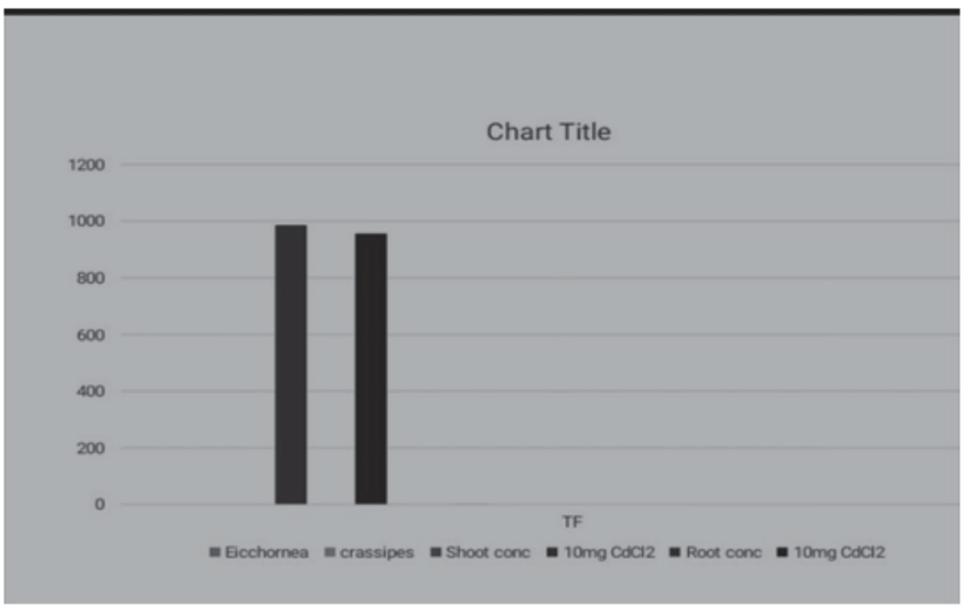

Fig. 3 Shoot, Root conc of Eicchornea crassipes at 10 mg CdCl2crassipes at 10 mg cdCl2

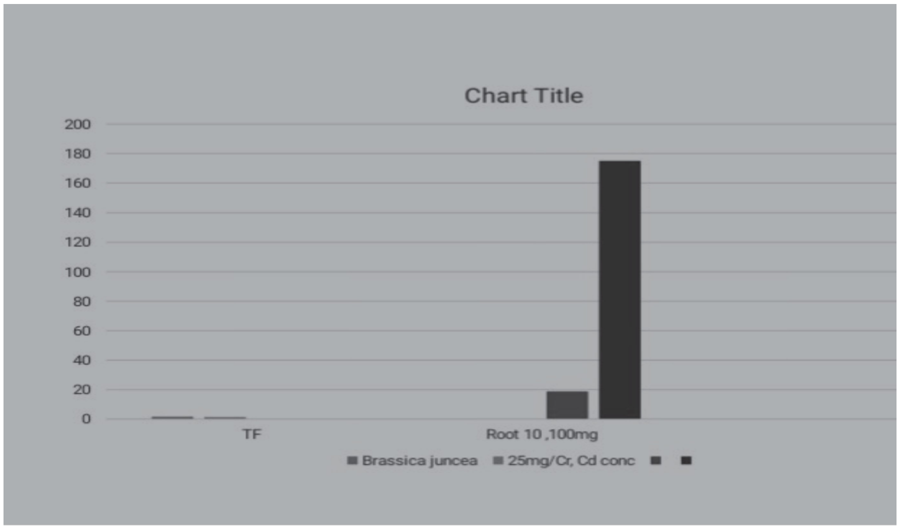

Fig. 4 Brassica juncea root at 10,100mg Cd conc.

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