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Phytoremediation of Chromium and Accumulation Pattern by *Heliotropium Curassavicum, Ipomea Cornea* and *Jetropha Gasifolia*

NirmalKumar Sarangam* R.Veeramani* K.K.Kavitha**

**Research Scholar, Department Of Environmental And Herbal Science, Tamil University, Thanjavur*
***Assistant Professor, Department Of Environmental And Herbal Science. Tamil University, Thanjavur*

Abstract: One of the bioremediation techniques is phytoremediation which is an emerging technology that uses plants to clean up pollutants (both metals and organics) from the environment. Within this field of phytoremediation, the utilization of plants to transport and concentrate metals from the soil into the harvestable parts of roots and above-ground shoots is usually called phytoextraction. Phytoremediation is still a developing technology. In the present study *Ipomea cornea, Jetrophagasifolia* and *Heliotropium curassavicum* L. were selected for Chromium accumulation study by hydroponic culture method.
Phytoaccumulation of Cr was studied initial day and after 30th day of Growth. The bioaccumulation study showed a linear relationship between increased concentration of Chromium accumulation and Cr treatment concentration. Cr^{+6} concentrations were found to be higher in *Heliotropium curassavicum* than in *Jatropha gasifolia* and *Ipomoea carnea*. Based on the present investigation it is suggested that Ipomoea cornea and *Heliotropium curassavicum* have better accumulation capacity for Cr remediation.
Keywords: Phytoremediation, Hydroponic culture and Chromium.

I. INTRODUCTION

Chromium metal contamination occurs from a variety of sources. Mine tailings, industrial practices, pesticides, car exhaust and sewage sludge treatment used as a fertilizer are major contributors to soil contamination (DoNacimiento *et al*., 2006; Jacob and Otte, 2004; Liphadzi *et al*., 2003; Madrid *et al*., 2003; Yang *et al*., 2005). It is one of the major ecological problems worldwide, leading to losses in agricultural yields and harmfully affects human health when contaminants enter the food chain. Cr is introduced into the ecosystem as a result of different anthropogenic and industrial activities such as in the production of steel and alloys, pigment manufacturing, plating, combustion of coal and oil, and leather tanning, chrome leather, chromium plating, wood preservation electroplating cleaning agents, catalytic manufacture and in the production of chromic acid and specialty chemicals (Shanker, *et al*., 2005, Sune, *et al.*, 2007; Liu *et al*., 2011). Pollution of agricultural fields with Cr is very toxic to both human being and plants has been led a major environmental concern over the last few years (Tiwari *et al*., 2013).

However, some plants are able to withstand a very high level of Cr through their physiological mechanism. Phytoremediation has recently attracted a great deal of pollution removal from soil. Some plant species vary significantly in the ability of accumulating metals from contaminated soils. There is a small number of plant species endemic to metalliferous soils that can tolerate and accumulate high levels of toxic metals.

The phyto accumulated plants can be incinerated, leaving an ash that contains 40% or more of the metal. Based on these research concepts the present study we taken up three weed plants dominantly present in and around tannery industry, Trichy.

II. MATERIALS AND METHODS

Hydroponic study

In the present study, the accumulation of hexavalent chromium ions by *Ipomoea carnea, Jetropha gasifolia* and *Heliotropium curassavicum* L. were studied by culturing the plant in hydroponic medium contaminated plant nutrient with chromium salt (containing K_2, Cr_2, O_7) The plant growth parameters were analysed by 5 day interval.

The present work to test the weed plants efficiency of phyto accumulation of Cr was analysed initial day and after 30th day by the following method. Five groups of selected plants were planted in a plastic tub of 5 litre capacity at four various concentrations of Cr in the following treatment T0,T1,T2,T3 (0, 5,10,15ppm) used in the present study were prepared by diluting the respective stock solution (1000 mg/L) appropriately with distilled water. (Plate – 1)

After 30th day of growth the plants were removed and thoroughly rinsed with distilled water. The plants were dried by shadow drying method and grind to 20 meshes using a stainless steel mixy grinder.

The ground material was digested using Nitric and per chloric acids (3:1). The resulting solution was analysed for metal content by using AAS Centre for Advanced Research in Indian System of Medicine (CARISM) SASTRA University Thanjavur.

The sample was diluted to 25ml and annualized for total metals by method for Cr AAS by (U.S EPA.1983) AAS (SHIMADZO – 7000 model).

PLATE-1

Hydroponic study a.*Jatropha gasifolia* and **b.***Heliotropium curassavicum* L.

A .*Jatropha gasifolia*

B. *Heliotropium curassavicum* L.

Statistical Analysis

All the data were analysed using the multiple mean comparison test (Agres Statistical Software) and the interrelationship between parameters were assessed using ANOVA (Analysis of Variance) analysis.

III. RESULTS AND DISCUSSION

A laboratory experiment was conducted to examine Cr^{6+} uptake capacities of three weed plants *Ipomoea carnea*, *Jetropha gasifolia* and *Heliotropium curassavicum* L. The selected weed plants were transferred to the laboratory containing hydrophonic culture method by using nutrient solution contaminated with 0,5,10 and 15 mg L-1 of $Cr^{+6.}$

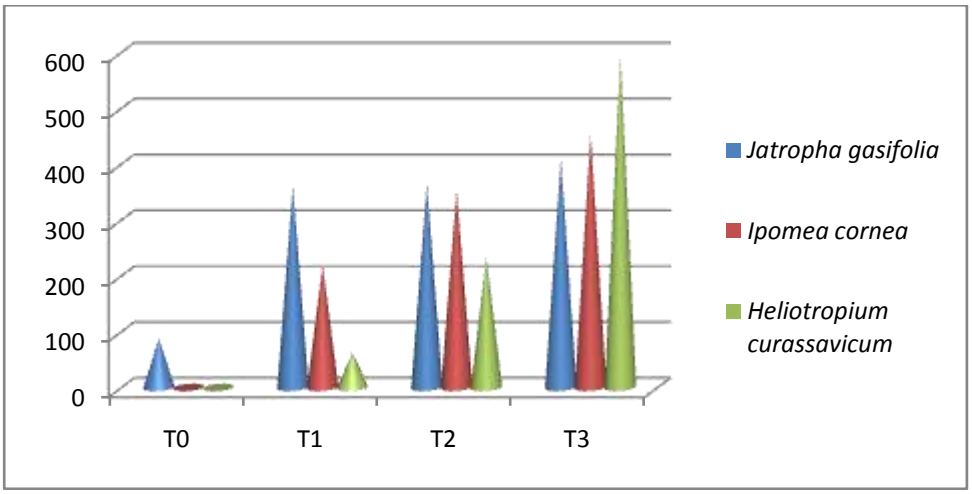
The bioaccumulation study showed a linear relationship between increased concentration of Chromium accumulation and Cr treatment concentration (Table-1 and Fig -1). Chromium accumulation was 220.3±0.421ppm in T1 and T3 454.1±0.143ppm in *Ipomea cornea.* Estimated chromium accumulation was 62.8±0.002 (T1), 233.3±0.0632 (T2) and 594.3±0.052 (T3) ppm in *Heliotropium curassavicum* with the exposure time (30 days). Cr+6 concentrations were found to be higher in *Heliotropium curassavicum*- than the in *Ipomea cornea* and *Jatropha gasifolia.*

Table 1: Chromium accumulation in selected three plants Biomass

s.no	Treatment/plant Species	Chromium accumulation (mg/kg)							
		0^{th} day				30^{th} day			
		To	T1	T2	T3	To	T1	T2	T3
1	*Jatropha gasifolia*	0	-	-	-	87.9±0.503*	360.9±0.012**	364.8±0.0241**	408.4±0.21**4
2	*Ipomea carnea*	0	-	-	-	0	220.3±0.421*	353.7±0.054**	454.1±0.143**
3	*Heliotrophium curassavicum*	0	-	-	-	0	62.8±0.002*	233.3±0.062**	594.3±0.052**

The values are Mean ± SEM, n=4, ** P < 0.01 and compared with Days and Treatment

Fig:1 Comparison of Chromium accumulation of *Jatropha gasifolia, Ipomea cornea, Heliotropium curassavicum* in three treated concentration [30 days Study].



Based on the present investigation it is suggested that *Ipomoea cornea* and *Heliotropium curassavicum* have better accumulation capacity for Cr remediation. Kavitha and Jagadeesan (2014) were studied similarly the Hg accumulation of *Jetropha curcas* was increased with increasing Hg concentrating in hydroponic culture. Do Nacimiento *et.al*., (2006) also reported phytoremediation of Cd, $Cr(3^{+})$, Ni (2^{+}), As (v), and Fe(11) by Helianthus annuus through hydroponic culture.

Based on the present investigation it is suggested that *Heliotropium curassavicum* L plant have better accumulation capacity for Cr phytoremediation and *Heliotropium curassavicum* L. clean- up of will be used to clean up of Chromoium contaminated effluents.

IV. CONCLUSION

Based on the present study the *Heliotropium curassavicum* L. and *Ipomea cornea* showed the better Cr accumulation. It is suggested that by using this plants to treat Cr contaminated effluent *Heliotropium curassavicum* L. and *Ipomea cornea* could be successfully used as Phtoremediaton. Further field trails are needed to confirm the above conclusion.

REFERENCE

[1]. Arun K. Shanker, Carlos Cervantes, Herminia Loza – Tavera and S. Avudainayagam . "Chromium toxicity in plants " ELSEVIER **Journal of Environment International** 31 (2005) 739–753

[2]. Do Nascimento, C. W. A. Amarasiriwardena, D. Baoshan, X. "Comparison of naturalorganic acids and synthetic chelates at enhancing phytoextraction of metals from a multi metal contaminated soil." **Environmental Pollution,** (140) 1: 114-123, (2006).

[3]. Jacob, D. L. and Otte, M. L. "Influence of Typhalatifolia and fertilization on metalmobility in two different Pb-Zn mine tailings types." **The Science of the Total Environment,** (333) 1: 9-24, (2004).

[4]. KavithaKadirvel, K. and Jegadeesan, M., 2014. "Mercury and cadmium accumulation in selected weed plants: Implications for phytoremediation." **Asian Journal of Plant Science and Research,** 4(5):1-4 (2014).

[5]. Liphadzi, M. S, Kirkham, K. R , Mankin, K. R., Paulsen, G. M., "EDTA-Assisted Heavy-Metal Uptake by Poplar and Sunflower Grown at a Long-Term Sewage-Sludge Farm," **Plant and Soil,** 257: 171-182, (2003).

[6]. Liu Yu, CaiQiuFang, Song HuiMing , An ZhiSheng., and Hans W. Linderholm."Amplitudes, rates, periodicities and causes of temperature variations in thepast 2485 years and future trends over the central-eastern Tibetan Plateau**." Chinese Science Bull October ,** Vol.56 No.28-29 (2011).

[7]. Madrid, F., Liphadzi, M. S. and Kirkham, M. B. "Heavy metal displacement in chelateirrigated soil during phytoremediation." **Journal of Hydrology,** (272) 1: 107-119, (2003).

[8]. U.S. EPA., 1983. Technical support manual: Water body surveys and assessments for conducting use attainability analyses. **U.S. Environmental Protection Agency,** Office of Water Regulations and Standards, Washington, D.C. Volumes 1-3.

[9]. Sune, N,. Sanchez, G., Caffaratti, S and Maine . "Cadmium and chromium removal kinetics from solution by two aquatic macrophytes. **." Journal of Environmental Pollution,** Volume 145, Issue 2, January 2007, Pages 467-473, (2007).

[10]. Tiwari Bharat P., Rane Bhushan R., Gujarathi Nayan A., Pawar Sunil P "An Overview: Sustained release drug Ddelivery technologies with polymeric system." **An International Journal of pharmaceutical Science** Vol - 4, Issue – 1, (2013).

[11]. Yang, X.; Feng, Y.; Zhenli, H.; Stoffella, P. J. "Molecular mechanisms of heavy metal hypera ccumulation and phytore mediation**." Journal of Trace Elements in Medicine and Biology,** (18) 4: 339-353, (2005).