IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Phytoremediation Strategies for Chromium Contaminated Soil

[1]Keerthi K, [2]Reena Abraham

[11]M. Tech scholar in Environmental Engineering, [2]Assistant Professor
[1]Department of Civil Engineering,
[1]KMCT College of Engineering for Women, Calicut, Kerala, India

Abstract : Heavy metals are among the most important sorts of contaminant in the environment. Several methods already used to clean up the environment from these kinds of contaminants, but most of them are costly and difficult to get optimum results. Currently, phytoremediation is an effective and affordable technological solution used to extract or remove inactive metals and metal pollutants from contaminated soil and water. This technology is environmental friendly and potentially cost effective. A study was conducted to find out the distribution of chromium content of a major dumping site in Kozhikode, Kerala and also the effectiveness of and Brassica juncea (Indian Mustard) and Cnidoscolus aconitifolius (Chaya Mansa) in phytoremediation of contaminated soils. The total chromium content of the dumping sites was higher than the permissible limit. The soil collected from dumping site was used for phytoremediation study with Brassica juncea (Indian Mustard) and Cnidoscolus aconitifolius (Chaya Mansa). Phytoremediation with Brassica juncea (Indian Mustard) showed that it has good phytoremediation compared to Cnidoscolus aconitifolius (Chaya Mansa).

IndexTerms **– Heavy Metals, Chromium, Phytoremediation, Dumping Site.**

1. INTRODUCTION

In the southern Indian city of Kozhikode, Kerala, the Njeliyanparambu waste dumping site exemplifies the pressing issues surrounding urban waste management. Once a quiet corner of the city, this site has garnered attention due to its adverse impact on the environment and public health. The discovery of chromium contamination in dumpsites adds another layer of complexity to the environmental challenges faced by this waste dumping site in Kozhikode. Phytoremediation, the use of plants to remove, degrade, or contain environmental contaminants, including heavy metals like chromium, presents a sustainable and cost-effective approach to addressing contamination at sites like Njelyanparambu. One promising candidate for phytoremediation in this context is Cnidoscolus aconitifolius, commonly known as Chaya Mansa. Moreover, Chaya Mansa exhibits traits such as high biomass production and fast growth rates, which enhance its effectiveness as a phytoremediator. Its extensive root system not only improves soil structure and stability but also increases the plant's access to water and nutrients, facilitating the uptake and removal of contaminants from the soil. Brassica juncea is known for its ability to accumulate heavy metals, including chromium, in its tissues through processes such as root uptake and translocation. By cultivating Brassica juncea at dumping site, we can leverage its natural metal-accumulating properties to remove chromium from the soil.

2. OBJECTIVE OF THE STUDY

The main objectives of the present study as follows

a. Assessment of Chromium Contamination:

Determine the concentrations of chromium present in the soil of dumping site.

b. Assess Phytoremediation Efficiency:

Evaluate and compare the effectiveness of Chaya Mansa (Cnidoscolus aconitifolius) and Indian mustard (Brassica juncea) in removing chromium from contaminated soil through phytoremediation.

c. Investigate Chromium Uptake:

Analyze the uptake of chromium by Chaya Mansa and Indian mustard plants from contaminated soil over a defined period.

3. RESEARCH METHODOLOGY

3.1 Study Area

Njeliyanparambu is a place on the outskirts of the city of Kozhikode in Kerala, India. It is located 6km away from Kozhikode and has gained prominence for being a dumping ground for Kozhikode city.

3.2 Soil Samples

A total of 3 soil samples were collected at a depth of 0-30 cm from 3 locations within the dumping site. Soil collected from Njelyanparambu was sieved to remove the bulky lumps and stones and dried. They were analyzed for pH, conductivity, organic carbon, potassium (K), and Calcium (Ca).

3.3 Plant Materials

Two plants were selected on the basis of their ability to accumulate Cr. These two plants are widely distributed, fast growing, hardy, easy to plant and maintain. Moreover, they have long life span, high propagation, and high biomass. The selected plants were Cnidoscolus aconitifolius (Chaya Mansa) and Brassica juncea (Indian Mustard). These plants were collected from nearby local areas of Kozhikode.

3.4 Experimental Design And Procedure

3.4.1 Test for Chromium

Soil samples collected from Njeliyanparambu of Kozhikode district used for the present study. Soil collected from dumpsite was sieved to remove the bulky lumps and stones and dried. The chromium concentration in all samples was analysed by Flame Atomic Absorption Spectrophotometer at CWRDM, Kozhikode.

3.4.2 Cr Uptake

This experiment was conducted in 20 cm diameter pots, each with three 1cm diameter drainage hole. A plate were placed under the pots to collect drainage water and this water was later poured back into the pots daily in order to prevent the loss of Cr through leaching. Three kilograms of soil was placed in each pot. Five hundred millilitres of water were applied equally to each pot daily in the morning. Upon treatment with Cr, the height of each plant was measured every 10 days test Cr uptake. The plant height was also measured.

4 RESULTS AND DISCUSSION

4.1 Chromium Concentration

The result of the chromium content at the dump site for one month is represented in the Table 5.1. The total chromium content at dumping site was higher than the permissible limit. The chromium content of was recorded as 112.6 mg kg-1 in the soils of Njeliyanparambu. After one month of planting of Indian Mustard chromium concentration decreases to 96.6mg/kg and similarly incase of Chaya Mansa it decreases to 105.8mg/kg, which is more than permissible limit.

Table 5.1: Chromium concentration after plantation

Chromium Concentration(mg/kg)	Brassica juncea (Indian Mustard)	Cnidoscolus aconitifolius (Chaya Mansa)
After 10 days of planting	108	110.5
After 20 days of planting	103.2	108.2
After 30 days of planting	96.6	105.8

Chart 1 shows the graphical representation of chromium concentrations in soil decreases with time duration of plantation.

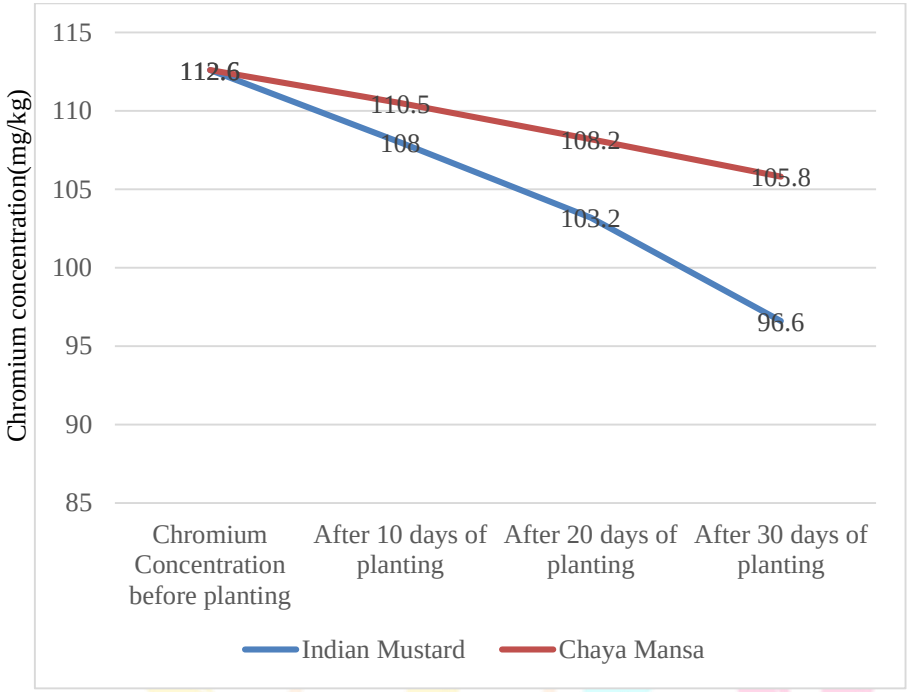

Chart-1: Graphical representation of chromium concentration in soil

5 CONCLUSION

Disposal of industrial and urban wastes causes contamination of the soil. It causes serious environmental concern and turns harmful to human beings and other living beings. So the knowledge of the sources of contamination is necessary for the selection of suitable remedial measures. Based on the above study, it has been concluded that the soil have chromium content in the soil.In the present study, Indian mustard (Brassica juncea), Chaya Mansa (Cnidoscolus aconitifolius) were used. Indian Mustard shows high accumulation compared to Chaya Mansa. The present study reveals that these plants could be used in phytoremediation to remove chromium from contaminated soil. So, the effective phytoremediation efficiency of chromium by Indain Mustard(Brassica juncea) proves that it can be used as a potential phytoremediator. This plant was very effective in removing this metal depending on time. So that, when the time increases the removal efficiency was increased.

Acknowledgment

I would like to express my sincere gratitude to my college [KMCT College of Engineering for Womens] for their valuable assistance and support during the preparation of this manuscript. Their expertise and encouragement have been instrumental in shaping this research. I am also grateful to the editorial team and reviewers of IJNRD for their constructive feedback and guidance.

.

REFERENCES

[1] Arathi, K. P. Rahna, Delse P. Sebastian and Satheesh George 2021 Assessment of Heavy Metal and Pesticide Contamination in Banana Fields and Development of Phytoremediation System in Kozhikode District, Kerala, India Nature Environment and Pollution Technology *An International Quarterly Scientific Journal.*

[2] Bieby Voijant Tangahu, Siti Rozaimah Sheikh Abdullah, Hassan Basri, Mushrifah Idris, Nurina Anuar, and MuhammadMukhlisin 2011 A Review on HeavyMetals (As, Pb, and Hg) Uptake by Plants through Phytoremediation *International Journal of Chemical Engineering* Volume 2011, Article ID 939161, 31 pages doi:10.1155/2011/939161.

[3] Barbara Rachele Ciaramella, Sebastiano Andrea Corinzia, Salvatore Luciano Cosentino and Giorgio Testa 2022, Phytoremediation of Heavy Metal Contaminated Soils Using Safflower,Article.

[4] Divya Vijayan V and P. K. Sushama 2017 Heavy Metal Contamination of Dumpyard Soils and its Phytoremediation with Vetiver Grass (*Chrysopogon zizaniodes*) *Nature Environment and Pollution Technology An International Quarterly Scientific Journal.*

[5] Bansah, K. J. and Addo, W. K. 2016, "Phytoremediation Potential of Plants Grown on Reclaimed Spoil Lands", *Ghana Mining Journal,* Vol. 16, No. 1, pp. 68 - 75.