



STUDY OF NATURAL RESISTANCE AND PHYTOREMEDIATION OF HEAVY METALS [Pb, Cd, Ni] IN INDIAN NATIVE PLANTS (*RICINUS COMMUNIS*, *BRASSICA JUNECA*)

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ABSTRACT

Heavy metals are the most important contaminants in the soil. Several methods are used to remove the heavy metals from the soil but using plants is easier and cost effective. Removal of heavy metals from the environment using plants is called phytoremediation. Accumulation of metals in the soil causes adverse effects, therefore removal of these metals is very important. In the present study, we have used Indian native Castor and Mustard plants for the removal of heavy metals from the soil. The Heavy metals (Pb, Cd, Ni) of known concentration were added to the soil in laboratory and the seeds of the two plants were sowed and was grown for three months. After three months when the soil was analyzed there was a decrease in the concentration of heavy metals in the soil of both the plants.

KEYWORDS : Phytoremediation, Indian native castor and mustard plants, lead nitrate, cadmium sulphate, nickel sulphate

INTRODUCTION

In today's world there is a huge discussion on measures taken towards environmental pollution. Undoubtedly industrialization and urbanization became a huge boon to human race, but it has also caused many negative results like pollution. Pollution is not only causing harmful effects to the organisms living in this world but it has also lead to global warming and is also leading to genetic disorders and diseases in human.

Soil pollution is mainly caused due to adverse effect of pesticides, insecticides, fungicides etc which are used in agricultural land field. Chemical or heavy metal contamination in soil is mainly caused by industrial effluents which are untreated. Soil pollution can also lead to ground water pollution, because rain water gets absorbed in these contaminated sites and takes away the toxics present in the upper surface of soil. Sites contaminated with high level toxic chemicals are not suitable for cultivation of edible crops.

Bioremediation deals with usage of living organisms for cleaning up of contaminated soil and water. 'REMEDiate' means to solve the problem and 'bioremediate' means to solve an environmental problem with the help of plants and microorganisms.

HEAVYMETAL -It is a dense metal or metalloid that is noted as potentially toxic to environment as well as living organisms.

Heavy metals are naturally found on earth they become toxic/harmful when they get concentrated beyond the safe limit due to human activities.

The plants which are natural and genetically resistant are taken for phytoremediation of soil contaminated by heavy metals. It is seen

that **Castor** (*Ricinus communis*) and **Mustard** (*Brassica juneca*) grow wildly and so must be naturally resistant to soil pollutants. These two plants are annual plants i.e. it grows throughout the year.

Castor (*Ricinus communis*) have a diploid chromosome number ($2n=20$). It reproduces with a mixed type of pollination. It can reach up to the height of 6-15 meters. It produces large leaves with 8 lobes and pointed tips. Castor seeds are used to produce castor oil and the leaves are used to feed Silk worms.

Mustard (*Brassicajuneca*) have different origins. Both are considered to be natural amphidiploids (AABB genome, $2n=36$) of *B. rappa* ($AA\ 2n=20$) *B. nigar* ($BB\ 2n=16$) crosses, it has chromosomal number $2n=18$. It is a perennial herb. It grows up to 1 meter or more it has 1-2 lobes and leaflets, seed germination within 5 days, grow rapidly and leaves are harvestable after 3 weeks. It is self-fertile, fruits develop rapidly and are ready for harvesting within 4 weeks from flowering. (Megha Kaushik ,2015, *BrassicaJuneca*, *Biotech article*)

MATERIALS AND METHODS

Heavy metals - lead nitrate, cadmium sulphate, nickel sulphate has been selected for the present study, Castor plants and Mustard plants were the plants selected. 1g of lead nitrate, 1g of cadmium sulphate and 1g of nickel sulphate were dissolved in 100 ml distilled water this was divided into 2 equal parts. One part was added to pot 1 containing 500g of soil in which mustard seeds were sown. Second part was added to pot 1 containing 500 g of soil in which castor seed were sown. Similarly, the above procedure was followed for 0.5 g and 0.25g of heavy metal compounds. 150-200 ml of water was poured every day for the growth of the plant.

REAGENTS USED FOR THE ANALYSIS OF HEAVY METALS IN SOIL:
 DTPA (diethylenetriaminepentacetate) Extractant: 0.005 M calcium chloride and 0.1 M Tri ethanol amine (TEA) with pH 7.3. Dissolve 149.2 g of reagent grade TEA, 19.67g DTPA in approximately 200 ml distilled water. Dilute to about 9L and adjust the pH to 7.3 using dilute HCl or NaOH and make up to 10L.

STANDARD SOLUTION OF MICRONUTRIENT CATIONS:
 All standards should be made from National institute of standards and technology (NIST) traceable Atomic absorption spectroscopy (AAS) grade primary standards.

For about 10 g of soil taken, DTPA extractant were added and was shaken for 2 hours in horizontal shaker. Later the suspension was filtered through what man No.40 filter paper. Later the sample was analysed with the instrument having an appropriate hallow cathode lamp and readings were recorded.

RESULT

In the present study, heavy metals of the range 1 ,0.5,0.25 grams were added to the soil, the castor seeds and mustard seeds were planted in each of these three concentrations. After 6 weeks castor plant in the pot containing 1 g of heavy metals dried and the plants in all the other pots continued to grow. After three months, the plants were uprooted and the soil and the whole plants were analysed for heavy metals.



Fig-1 CASTOR AND MUSTARD PLANT CONTROL (without added heavy metals)

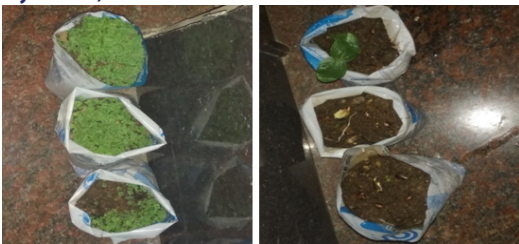


Fig-2 MUSTARD AND CASTOR PLANTS(AFTER 5 DAYS OF SOWING THE SEEDS IN POTS CONTAINING HEAVY METALS)



Fig-3 GROWTH OF CASTOR AND MUSTARD PLANTS (DURATION 6 WEEKS AFTER SOWING SEEDS).

Analysis of different concentration of heavy metals in soil in which Mustard plants were grown (after 3 months)

The concentration of heavy metals, i.e. lead, cadmium and nickel in the soil is as given below.

TABLE- 1

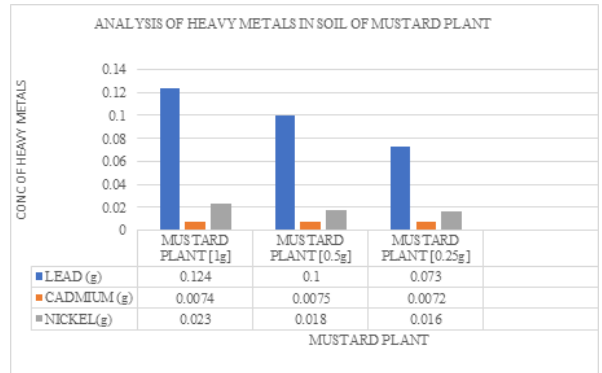
	LEAD	CADMIUM	NICKEL
MUSTARD PLANT (1g) in Pot 1	0.124	0.0074	0.023
MUSTARD PLANT (0.5 g) in pot 2	0.100	0.0075	0.0184
MUSTARD PLANT (0.25g) in pot 3	0.073	0.0072	0.01612

Mustard plant grown in Pot 1(soil containing 1 gram of lead, cadmium, nickel compounds) showed drastic reduction in the concentration after 3 months with 0.124 g,0.0074 g ,0.023g respectively.

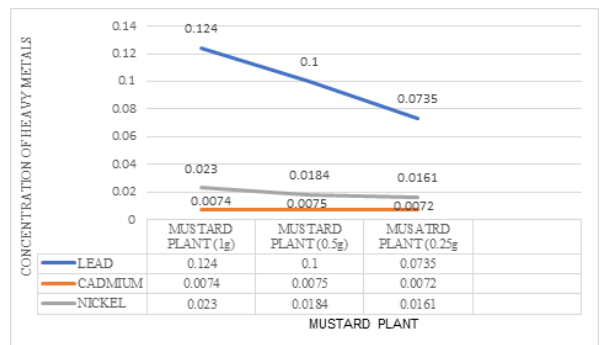
Mustard plant grown in Pot 2 (soil containing 0.5g of lead, cadmium, nickel compounds) showed drastic reduction in concentration after 3 months with 0.100g,0.0075g,0.0184g respectively.

Mustard plant grown in Pot 3 (soil containing 0.25 g of lead, cadmium, nickel compounds) showed drastic reduction in concentration after 3 months with 0.073g,0.0072g,0.01612g respectively.

GRAPH -1 ANALYSIS OF HEAVY METALS IN SOIL OF MUSTARD PLANT GROWN (AFTER 3 MONTHS)



GRAPH-2 ANALYSIS OF HEAVY METAL IN SOIL OF MUSTARD PLANT GROWN (AFTER 3 MONTHS)



Analysis of different concentration of heavy metals in soil where castor plants were grown (after 3 months)

TABLE- 2

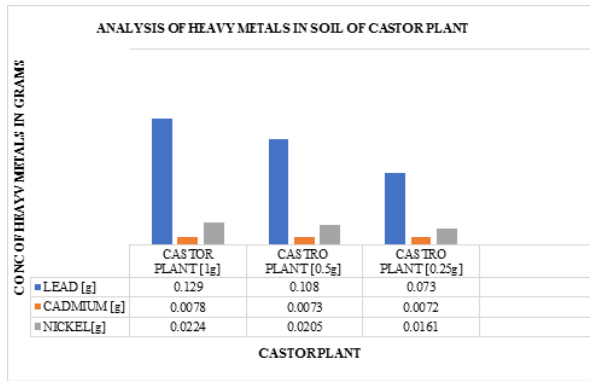
	LEAD	CADMIUM	NICKEL
CASTOR PLANT (1g) in Pot 1	0.129	0.0078	0.02242
CASTOR PLANT (0.5g) in pot 2	0.108	0.0073	0.02050
CASTOR PLANT (0.25g) in pot 3	0.073	0.0072	0.01612

Castor plant grown in Pot 1(soil containing 1 gram of lead, cadmium, nickel compounds) showed drastic reduction in concentration after 3 months with 0.129g,0.0078g,0.02242g respectively.

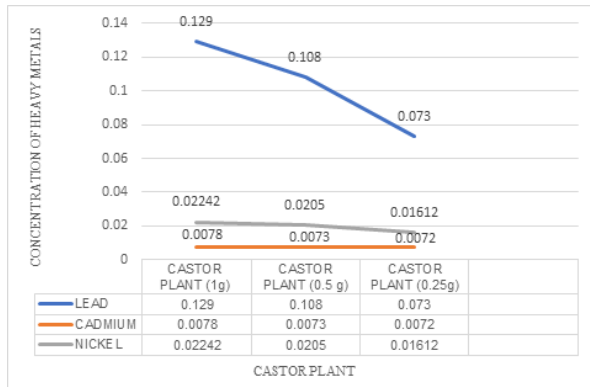
Castor plant grown in Pot 2 (soil containing 0.5g of lead, cadmium, nickel) showed drastic reduction in concentration after 3 months with 0.108g,0.0073g,0.02025g respectively.

Castor plant grown in Pot 3(soil containing 0.25g of lead, cadmium, nickel) showed drastic reduction in concentration after 3 months with 0.073g,0.0072g,0.01612g of respectively.

GRAPH-3 ANALYSIS OF HEAVY METAL IN SOIL OF CASTOR PLANT AFTER 3 MONTHS



GRAPH 4- ANALYSIS OF HEAVY METALS IN SOIL OF CASTOR PLANT GROWN AFTER 3 MONTHS



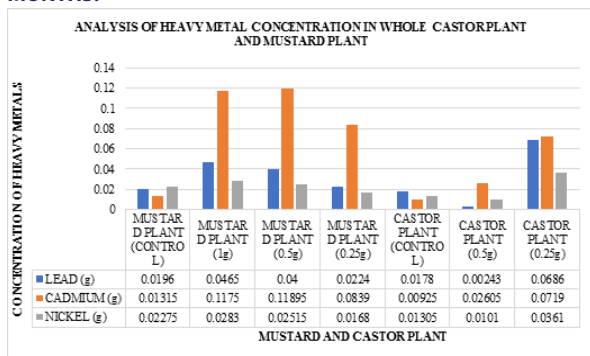
Analysis of different concentration of heavy metal in whole castor plant and mustard plant After 3 months

The concentrations of heavy metals i.e. Lead, cadmium, nickel in the plant is as given below.

TABLE-3

	LEAD(g)	CADMIUM(g)	NICKEL(g)
MUSTARD PLANT (CONTROL)	0.01965	0.01315	0.02275
MUSTARD PLANT (1 g)	0.04655	.1175	0.0283
MUSTARD PLANT(0.5g)	0.04001	.11895	0.02515
MUSATRD PLANT (0.25g)	.0224	.0839	.0168
CAS TRO PLANT (CONTROL)	.0178	.00925	0.01305
CAS TRO PLANT (0.5g)	0.02435	.02605	0.0101
CAS TRO PLANT((0.25g)	0.0686	.07195	0.0361

GRAPH 5: ANALYSIS OF HEAVY METAL COCENTRATION IN WHOLE CASTOR PLANT AND MUSTARD PLANT AFTER 3 MONTHS.



Thus, from the above results obtained we can interpret that when compared to mustard and castor plant, both plants more or less equally accumulate the heavy metals in them and thus helps in removal of toxic metals from contaminated soil

CONCLUSION

Based on our work we can conclude that Indian native plants (castor and mustard) absorb Heavy metals lead, nickel, and cadmium from the soil. These plants may be grown in contaminated sites which helps in the removal of these heavy metal from soil.

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