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Phytoremediation Using Dahlia Pinnata plants for Treatment of effluents contaminated soil/ site of Kota Rajasthan

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ABSTRACT: The ever-increasing environmental pollution in agricultural soil caused by pollutants and heavy metals due to application of industrial waste water, sewage sludge, city refuse, and heavy metals containing fertilizers or pesticides, is becoming a major problem in present time. Due to rapid and uncontrolled industrialization and anthropogenic activities in Kota, the environmental pollution increased rapidly. The discharge of waste water from industries such as stone, chemical, fertilizers, Textile etc. pollute soil flora fauna. Quality of soil is degrading day by day and activities are adversely affected.

In this paper various locations have been identified and pollution level of soil at the vicinity of Kota has been measured.

The present study is dealing with Assessment of effluent contaminated or irrigated soil and characterization of these in order to find out the physiological loads put in by the effluent generated from industries in Kota region of Rajasthan. This study will also help to find out the impacts of effluents on corresponding soil and water ecology.

Selection of native plants for treatment work also accompanied with the survey of various wetlands of Kota as well as detail review of literature .the plants selected for the study on the basis of survival in local conditions and growth pattern. The plants selected for soil treatment were new as a phytoremediator and selected after primary results obtain from experiment for their removal capacity and with consultation of scientist of CSIR laboratory in Lucknow known as National botanical research institute. Also suggestion and references were taken from scientist of Ministry of Environment and Forest, govt. of India and National Environmental Engineering Institute, Nagpur.

The research study has been divided in two main part first is assessment second is treatment of contamination for soil in Kota region. The industrial effluents which are contaminating the soil as the industrial effluents in Kota found passing through the agriculture areas where the intensive agriculture activities is carried out by farmers. The agriculture area extensively affected by the industrial waste water especially in rainy season the flow of slurry waste water in raipura region of Kota become a serious problem and become a flooded area with waste water. In Raipur region where the effluent is passing through the agriculture farmland this land observed heavily contaminated with the heavy metals. during the observation it has been found that the value of metal like copper are found up to a danger limit as it is noticed here about 69 ppm in soil which is contaminated with Multi-metals industry waste water, also more than the permissible limit which is about 2 ppm. So this value is more 35 times than the permissible limit which leads to the Bio magnification in local crop, leads to various disease in human as well as animals. Out of 32 samples most of the samples observed more than the permissible limit of pollutant declared by BIS India. Iron content recorded maximum 31.08 ppm in soil sample sewage treatment plants of Dhakadkhedi Kota, this soil is contaminated with waste water which is flowing towards to STP. Zn reached up to 22.91 ppm in soil sample of Raipura also more than 39 times the permissible limit of .6 ppm. Mn observed maximum in Multi-metals soil samples as it is known that multi-metal is metallic parts manufacturing unit in Kota so the effluent is laden with more metallic content. Thus with all this observation it is cleared that soil is badly affected due to industrial effluent in study area. Organic pollutant like

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phosphate, OC, etc. also found more than the approved limit of various organization however this pollutant loads beneficial for agriculture purpose but excess amount of this leads bio magnification in crops. phosphate, potash, sulphur were recorded in soil serially 825 kg/hect, 6440 kg/hect, 878 kg/Hect in soil samples of Sanjhdheda, Ranpur Industrial, Multi-Metals area soil. This high amount of pollutants in soil causes various problems in crop and soil flora & fauna.

After the characterization of soil parameters the decontamination of soil done by selected phyto-remediator plant for 3 month span has taken for soil treatment by dehelia. dehelia plants for 3 month applied for most contaminated samples from 8 samples which means out of 32 sample total 16 highest contaminated soil has been treated. The reduction of pollutants serially shown by dahliapinnata plant which reduce about 70-75 % of heavy metals from the contaminated soil matrix. The soil sample has been tested every 10th days up to 2 month after first observation on 30th day. Plants selected here for decontamination found also suitable for removal of organic component as these pollutants assimilated by plant as food. Zn, Cu, Fe, Mn also serve as micronutrient but here they found in too much high range more than the permissible limit set by FAO, USA and BIS India.

I. INTRODUCTION

Human activities all over the earth have increased environmental pollution by heavy metals and other pollutants in soil and produced huge quantity of polluted waste water. Phytoremediation is a new technology in which plants are used to remove pollutants from waste water and contaminated soil. The use of solar driven method and metal-accumulating plants to clean environment contaminated with heavy metals is the most rapidly developing component of this environmentally friendly and cost-effective technology.

The ever-increasing environmental pollution in agricultural soil caused by pollutants and heavy metals due to application of industrial waste water, sewage sludge, city refuse, and heavy metals containing fertilizers or pesticides, is becoming a major problem in modern era. This work reviews assessment of problem, remediation technologies as well as heavy metal accumulation in ornamental plants in Kota region.

II. BACKGROUND ART OR HISTORY OF WORK DONE ON PHYTOREMEDIATION OF CONTAMINATED SOIL

Scott D. Cunningham, William R. Berti, et al. worked on phytoremediation of contaminated soil & observed Plant-based remediation techniques having increasing promise for use in soils contaminated with organic and inorganic pollutants. Two contrasting approaches to remediation are being pursued: pollutant-stabilization and containment, where soil conditions and vegetative cover are manipulated to reduce the environmental hazard; and decontamination, where plants and their associated microflora are used to eliminate the contaminant from the soil.

Phytoremediation of Soils Contaminated with Metals and Metalloids at Mining Areas: Potential of Native Flora by **Paulo J.C. Favas, Rohan D'Souza et al.** in Brazil assessed the Physico-chemical properties of the metalliferous or metal-contaminated soils tend to inhibit soil-forming processes and plant growth.



Figure-1 Phytoremediation of Contaminated sites using plants.

Degraded soils of mines usually have low concentrations of important nutrients, like N, P and K. Toxic metals can also adversely affect the number, diversity and activity of soil organisms, inhibiting soil organic matter decomposition and N mineralization processes.

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Metal toxicity issues do not generally arise in the case of native flora, considering that native plants become adapted over time to the locally elevated metal levels. Native plants may be better phytoremediators for contaminated lands than the known metal hyper accumulators because these are generally slow growing with shallow root systems and low biomass. Plants tolerant to toxic metals and low nutrient status with a high rate of growth and biomass are the ideal species to remediate degraded soils and habitats like those around mines. The native flora displayed its ability to withstand high concentrations of heavy metals in the soil. Some species also displayed variable accumulation patterns for metals at different soil concentrations..

III. METHODOLOGY

The sampling has done in Kota throughout the year so that climate variation has also been observed on pollutants loads it is a part of research work. The study is basically focused on industrial effluents which are contaminating the soil as the industrial effluents in Kota found passing through the agriculture areas where the intensive agriculture activities is carried out by farmers. The agriculture area extensively affected by the industrial waste water especially in rainy season the flow of slurry waste water in Raipura region of Kota become a serious problem and become a flooded area with waste water.

IV. OBSERVATIONS AND ANALYSIS- TREATMENT OF SOIL USING DAHLIA

S.No	Location	Ec	OC	Phosphate	Potash	Sulphur	Zn	Cu	Mn	Fe
	Permissible limit ISI standard	0-1	.5-.75	23-56	142-337	330	.6	.2	2.0	4.5
	UNITS	ds/m	%	Kg/ Hect	Kg/Hect	Ppm	Ppm	Ppm	ppm	Ppm
1-	RAIPUR A	1.26	.97	105	246	346	11.9	6.6	10.9	2.15
	30 day later			87	208	278	7.8	4.3	7.20	1.76
	40 days later			63	176	242	5.9	2.6	5.42	1.24
	50 days later			38	138	208	3.2	1.3	3.86	1.04
	60 days later	.68	.65	21	106	168	1.4	.56	1.92	.38
2-	DCM Area	.42	1.28	55	403	189	8.83	7.0	12.5	20.9
	30 days later			38	338	146	6.24	5.2	9.8	16.7
	40 days later			26	296	114	4.90	4.4	7.6	13.2
	50 days later			18	244	86	2.68	2.8	5.2	10.3
	60 days later	.28	.58	07	186	54	1.24	1.4	3.8	7.4
3-	MM Area	.73	2.32	137.5	1064	762	10.9	4.7	24.2	28.4
	30 days later			98	872	580	8.3	3.4	18.6	23.6

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	40 days later			72	689	418	6.7	2.64	12.3	19.7
	50 days later			48	568	290	4.6	1.54	8.81	15.8
	60 days later	.34	.62	24	442	180	2.3	.68	5.4	11.4
4-	CETP khedi	.69	3.89	385	347	600	7.74	2.50	15.62	27.74
	30 days later			332	298	542	5.90	1.85	11.23	21.45
	40 days later			274	242	486	4.12	1.18	8.42	17.4
	50 days later			226	198	426	3.14	.74	5.63	13.6
	60 days	.32	1.24	154	136	368	2.34	.23	2.68	8.56

V. RESULTS AND DISCUSSION

The study is basically focused on industrial effluents which are contaminating the soil as the industrial effluents in Kota found passing through the agriculture areas where the intensive agriculture activities is carried out by farmers. The agriculture area extensively affected by the industrial waste water especially in rainy season the flow of slurry waste water in Raipura region of Kota become a serious problem and become a flooded area with waste water.

The value observed from raipura, DCM area, multimetals area, CETP for S, Zn, Cu, Mn, Fe were beyond the permissible limit.raipura region observed values serially 246,11.9,6.6,10.9,2.15 ppm serially for S, Zn, Cu, Mn, Fe.the final reduction after treatment using dahlia gives us values of for S, Zn, Cu, Mn, Fe serially 168,1.4,.56,1.92,.38 after treatment of 60 days using dahlia plant for raipura contaminated field.

DCM area having values of 189, 8.83, 7.0, 12.5, 20.9 ppm serially for S, Zn, Cu, Mn, Fe. while multimetals area observed maximum contamination in soil with 762, 10.09, 4.70, 24.7, 28.2 ppm. Using dahlia these values from DCM area reduced to 54, 1.24, 1.4, 3.8,.74 ppm from the initial values. For multi-metals contaminated soil it is also show good response and reduced the values up to 180,.2.3,1.68,5.4,11.4 ppm serially for S, Zn, Cu, Mn, Fe.

VI. CONCLUSION

In Raipura region where the effluent is passing through the agriculture farmland this land observed heavily contaminated with the heavy metals. during the observation it has been found that the value of metal like copper are found up to a danger limit as it is noticed here about 69 ppm in soil which is contaminated with Multi-metals industry waste water, also more than the permissible limit which is about 2 ppm. So this value is more 35 times than the permissible limit which leads to the Bio magnification in local crop, leads to various disease in human as well as animals. Out of 4 samples most of the samples observed more than the permissible limit of pollutant declared by BIS India. Iron content recorded maximum 31.08 ppm in soil sample sewage treatment plants of Dhakadkhedi Kota, this soil is contaminated with waste water which is flowing towards to STP. Zn reached up to 22.91 ppm in soil sample of Raipura also more than 39 times the permissible limit of .6 ppm. Mn observed maximum in Multi-metals soil samples as it is known that multi-metal is metallic parts manufacturing unit in Kota so the effluent is laden with more metallic content. Thus with all this observation it is cleared that soil is badly affected due to industrial effluent in study area. Organic pollutant like phosphate, OC, etc also found more than the approved limit of various organization however this pollutant loads beneficial for agriculture purpose but excess amount of this leads bio magnification in crops. phosphate, potash, sulphur were recorded in soil serially 878 kg/Hect in soil samples of ,Multi-Metals area soil. This high amount of pollutants in soil causes various problems in crop and soil flora & fauna.

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After the characterization of soil parameters the decontamination of soil done by selected four phytoremediator plants throughout the year. 3 month span has taken for soil treatment by dahlia. The highest reduction of pollutants serially shown by dahlia pinnata plant which reduce about 70-75 % of heavy metals from the contaminated soil matrix. other values also reduced up to 90% as discussed in result and discussion of the paper. The soil sample has been tested every 10th days up to 2 month after first observation on 30th day. Plants selected here for decontamination found also suitable for removal of organic component as these pollutants assimilated by plant as food. Zn, Cu, Fe, Mn also serve as micronutrient but here they found in too much high range more than the permissible limit set by FAO, USA and BIS india.

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