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RESEARCH ARTICLE

ASSESSMENT OF HEAVY METALS CONTENT IN PARA GRASS (*UROCHOLA MUTICA)* FROM WASTE DISCHARGE OF GUNTUR, ANDHRA PRADESH, INDIA

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ABSTRACT

The purpose of study was to assess the accumulation of heavy metals (Zinc, Nickel, Copper, Manganese, Cadmium, Chromium, Iron, and Lead) in agricultural soils and their uptake by grass being irrigated by municipal sewage water. In current time the environment is heavily polluted by various toxic metals, which create a danger for all living beings. Phytoremediation can be potentially used to remediate metal contaminated sites. it has been observed that high amounts of heavy metals such as Fe>Zn>Mn>Cu>Cr>Ni>Cd>Pb in the para grass (*Urochola Mutica*) samples according to the Indian Standards. Effluent contains nutrients as well toxic components depending upon the source of production. The direct discharge of sewage from Automobile Industry and industrial effluents contaminate the agricultural soils in the study region. Present study highlights the fact that *Urochola Mutica* accumulates large concentration of heavy metals, therefore can play an important role in the phytoremediation but transfer the metals into animals through food chain.

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INTRODUCTION

The rapid development of urbanization, industrialization and population explosion together with the shortage of availability of fresh water for irrigation led to the rising use of sewage for agricultural land irrigation. (He *et al*., 2004, CPCB, 2008, Chandran *et al*., 2012), Heavy metals are released into the environment through domestic and commercial activities and industrial effluents, pesticides and fungicides as well as manure from poultry farms in agricultural region. Due to the rapid increase of the population in India, a high degree of generation of solid waste is taking place at a rate faster than they can be evacuated. Municipal solid waste usually contains paper, food waste, metal scraps, glass, ceramics, ashes, etc. Heavy metals are metals and metalloids having atomic densities greater than 5g/cm^3, (Wild, 1993). They include Zinc, Nickel, Copper, Manganese, Cadmium, Chromium, Iron, and Lead. At some levels of exposure and absorption, they are harmful to most living things. Decomposition or oxidation process releases the heavy metal contained in these wastes to the soil of the waste dumpsite thereby contaminating the soil (Ukpong, *et al*., 2013).

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Very often waste dumpsites around Guntur city sometimes utilised for cultivation of crops resulting in increased metal uptake by these crops. According to John, *et al*. (1972), the bio accumulation of these metals in plant tissue constitutes a hazard to man on consumption. The higher the concentration of these metals in soils, the higher the uptake by plant. Heavy metal accumulation in plants depends upon plant species and the efficiency of different plants in absorbing metals and is evaluated by either plant uptake or soil-to-plant transfer factors of the metals (Rattan *et al*., 2005). Apart from uptake by plant, they can also be leached into underground water sources. Voogt, *et al*. (1980) noted that even slow movement of heavy metals in the soil profile may result in the deterioration of ground water quality. Other sources of heavy metals in the environment include: gas from automobile exhaust fumes, and chemical discharges from industries into the soil. Once these metals enter the soil, they are not static but are absorbed by plant, which is a source of nutrient to man.

The metal accumulation in different plant parts depends on the availability and chemical form of metals in soil, their translocation potential, and type of plant species with their stage of maturity. A number of factors such as climate, atmospheric deposition, the concentrations of heavy metals in soil, the nature of soil on which vegetables are grown also affects bio-concentration of heavy metals in vegetables (Akbar Jan *et al*., 2010). Since these metals constitute a hazard to man and other living things they require a more serious attention. One of the major sources of heavy metal in around the Guntur city is leachate from waste dumpsite. Collection and disposal of solid waste has therefore become one of the greatest problems facing today. These metals are non degradable in soil and gradually bio-accumulate until it reaches toxic level. Grass and plants grown on such soils pick up these metals and transfer them to animals and to man, the ultimate consumer of such grass. This sometimes leads to increase the concentration of metals and damage the organs of these consumers. Many of these heavy metals are highly toxic at exceeded concentration and thus needs modern improving wastewater treatment techniques for their remediation. However in developing countries like India, lack of technical knowledge, mismanagement of environmental policies and limited financial resources has given rise to serious challenge due to these contaminants.

Plenty of work has been carried out by different researchers over different ecological aspects from time to time viz. Zutshi and Gopal, 2000; Kundenger and Abubaker, 2004; Qadri and Yousuf, 2005; Iqbal *et al*., 2008; Yaqoob and Pandit, 2009; Saba and Wanageo, 2010, Khan *et al*., 2012 and Mushtaq *et al*., 2013 and Mushtaq *et al*., 2014. However, assessment of heavy metal and their uptake and consequences on different basins have been scantly reported till date, this paper presents a study of uptake of heavy metals by the para grass (Urochola Mutica) in waste deposit regions

MATERIALS AND METHODS

Study area

Guntur is a city in the Guntur district, Andhra Pradesh. It is situated in Guntur mandal of Guntur revenue division. The city is a municipal corporation and the administrative headquarters of Guntur mandal, Guntur revenue division and the Guntur district as well. It is a part of Andhra Pradesh Capital Region, under the jurisdiction of APCRDA. It is the third most populous city in the state with a population of 743,354, and an urban agglomeration population of 1,028,667. Guntur Plains: Guntur is located at 16.20°N 80.27°E. It has an average elevation of 33 m (108 ft) and is situated on the plains.

Sample preparation and plant analysis

A total of eight samples were collected from the study area. in polythene bags (1kg), and labeled as sample numbers S1, S2,S3, S4,S5,S6,S7 and S8. The shoot parts of Urochola Mutica (Para grass) were washed with tap water followed by distilled water to eliminate attached soil particulates. The samples about 0.5-1 g oven-dried and ground leaf samples were accurately weighed into small cruciarebles at 70-80^{0}C until a constant dry weight was attained. The dried samples were grinded in washed and dried wooden mortar to make a fine powder. The finely grinded samples were passed through 0.5mm nylon mesh sieve and packed in the air tight polythene bags to prevent the adsorption of water from the humid environment, then moistened with concentrated HNO_3. The powder was solubilised in acid mixture (nitric acid and perchloric acid).The samples were then analyzed using Atomic Absorption Spectrophotometer as per standard methods (Baker & Amacher 1982; Burau 1982; Gambrell and Patrick 1982). The sample preparation technique for plants involves steps like, washing, drying, grinding, and storage. The plant samples were prepared according to the method recommended by Jones 1972 & Amma 1990.

RESULTS AND DISCUSSION

The present analysis has revealed that the concentration of heavy metals in the Para grass (Urochola Mutica) through Phytoremediation in the sewage drain region around the Guntur city. The results were showed in Table 1 & 2, the concentration levels determined in the present study were comparable generally to those previously found the heavy metals concentrations were observed in soils and plants grown areas (Geert *et al*, 1990, Camazano *et al*., 1994, Dudca *et al*., 1996). The Zn maximum and minimum concentrations were recorded in S4 & S8 values are 55.38mg/l and 16.35mg/l, the mean value of Zinc is 33.517 mg/l. compare with the standard level that showed in Table 1 & Figure 1 beyond the Permissible limit (IS 1992), (Usha Damodhar and M.Vikram Reddy., 2012). It is an essential micronutrient that affects several metabolic processes of plants (Rout and Dass, 2003) and has a long biological half-life. The phytotoxicity of Zn decrease in growth and development, metabolism and an induction of oxidative damage in various plant species like Tobacco (Tkalec *et al*., 2014).

Table 1. Heavy metal concentration in Para grass and permissible limits

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	Permissible limit
Zn	40.7	45.21	35.12	55.38	21.37	19.72	34.29	16.35	5
Ni	1.7	1.6	2.8	3.9	1.4	1.8	1	0.5	0.05
Cu	8	5.4	3.8	6.7	2.9	6.12	4.07	2.92	0.05
Mn	42.8	36.15	27.58	38.11	16.7	12.94	28.8	10.28	0.1
Cd	0.5	1.5	1.05	2.31	1.5	0.5	0.001	1.5	0.01
Cr	4.6	6.71	5.18	3.8	2.54	2	4.28	3.49	0.05
Fe	171.5	159.27	95.31	104.61	88.64	142.37	94.41	152.92	0.3
Pb	1.4	1.62	0.5	1.41	0.01	1.5	1.38	0.43	0.1

Table 2. Statistical analysis of heavy metals in Para grass

Parameters	Min	Max	Mean	SD
Zn	16.35	55.38	33.5175	13.63867
Ni	0.5	3.9	1.8375	1.064945
Cu	2.9	8	4.98875	1.864889
Mn	10.28	42.8	26.67	12.20557
Cd	0.001	2.31	1.107625	0.743922
Cr	2	6.71	4.075	1.491002
Fe	88.64	171.5	126.1288	33.72744
Pb	0.01	1.62	1.03125	0.615756

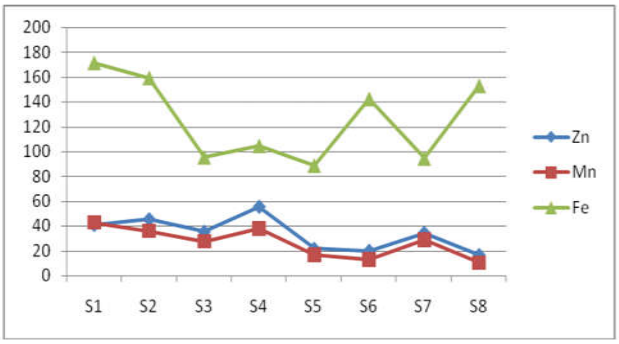

Figure 1. Zn, Mn, Fe concentrations in samples

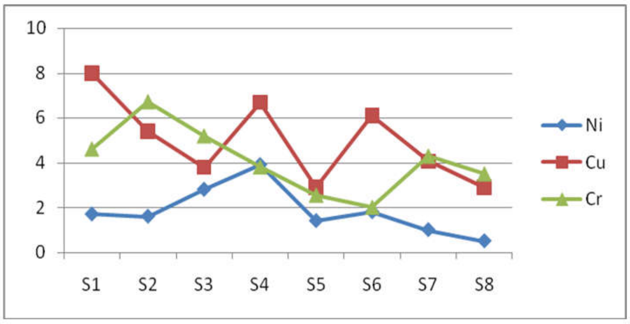

Figure 2. Ni, Cu, Cr Concentration in Samples

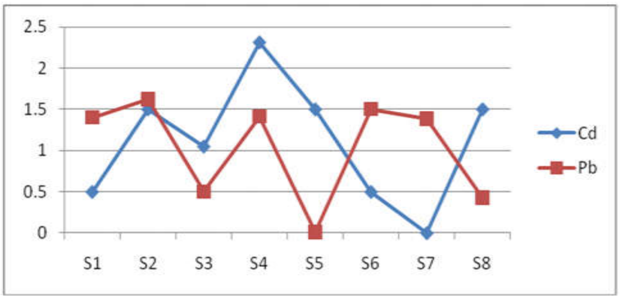

Figure 3. Cd and Pb concentrations in the samples

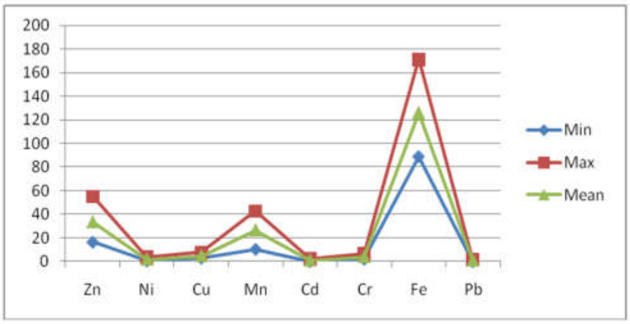

Figure 4. Minimum, Maximum and Mean concentrations of heavy metals

The maximum and minimum concentration of Nickel recorded in S4 & S8 the value were 3.9, 0.5 mg/l and the mean value is 1.837 in grass (Figure 2 & 4), Nickel is nutritionally essential trace metal for least several animal species, micro-organisms and plants. Therefore either deficiency or toxicity symptoms can occur when too little or too much Ni is taken up. Similar findings were reported in earlier research (Rohokale, 2015) the Cu maximum and minimum levels (8 mg/l and 2.9mg/l) were recorded in S5, S1 sampling stations, the average is 4.988 (Figure 2 & 4). The maximum and minimum concentrations of the Mn were 42.8mg/l and 10.28mg/l in S1 and S8. The mean value of Mn in study area is 26.67mg/l (Figure 1 & 4). The Cadmium high concentration was recorded in the S4 (2.31mg/l), the minimum contraction was recorded in S8 (0.001mg/l) and the mean value is 1.107mg/l (Figure 3 & 4). the most dangerous pollutants due to its high-potential toxic effects, and is extremely toxic, and the primary use of water high and cause adverse health effect to consumers such as renal disease and cancer (Suresh *et al*. 2015). the Cr maximum and minimum values are in S2 and S6 Sampling stations that are 6.71mg/l & 2 mg/l, and the mean value is 4.075mg/l (Figure 2 & 4). the Iron maximum concentration in S1-171.05 mg/l and the minimum level is in S5-88.64mg/l, the mean value is 126.12mg/l (Figure 1 & 4) the Lead maximum and minimum levels in S2 (S5 1.62mg/l & 0.01mg/l) (Figure 3). The industrial effluents may increase the lead concentration in soils and accumulate into the grass (Voutsa *et al*., 1997).

Increasing environmental awareness and concern is required to extend its exploitation in phytoremediation and accumulate the pollutants and heavy metals. Most of the studies on phytoremediation (Maine *et al*., 2004; John *et al*., 2008; Mishra and Tripathi, 2008) have been conducted in laboratory or greenhouse settings using metal-enriched nutrient solutions and showed impressive results with high metal uptake or accumulation (Mashkani & Ghazvini 2009). The increase of heavy metals concentration in all sampling stations were Fe>Zn>Mn>Cu>Cr>Ni>Cd>Pb, the high concentration is Fe and the low concentration is Pb (Figure 4) but in all sampling stations grass shoot having more concentrations of metals because the sewage is release from the Automobile industrial regions and domestic waste water from the Guntur municipality.

Conclusion

The long-term use of industrial effluent, Automobile waste water and municipal sewage for irrigation may increase the concentrations of the Heavy metals Zn, Ni, Cu, Mn, Cd, Cr, Fe and Pb in surface soil. In the above discussion the results have been observed that high amounts of heavy metals such as Zn, Ni, Cu, Mn, Cd, Cr, Fe and Pb according to the Indian Standards (IS: 10500, 1992). Sewage and Effluent contains nutrients as well as toxic components depending upon the source of production. Thus, it is clear that the waste water which drains from automobile and industrial effluents contains high concentration of heavy metals and can be used for agricultural irrigation after giving suitable treatment. Water treatment plants should be installed nearby Guntur city. Time to time assessment of the ground water around Guntur city is required.

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