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ASSESSMENT OF HEAVY METALS CONTENT IN SURFACE AND SUB SURFACE SOIL SAMPLES IN WASTE DUMPSITES OF GUNTUR, ANDHRA PRADESH.

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Abstract - In present the environment is highly polluted by various toxic metals, which create a danger for all living beings, the major (heavy metal) pollutants in the environment, particularly in areas with anthropogenic activities and industrial activities etc., the levels of heavy metals were assessed in five randomly chosen in dump site, samples were drawn at the depth of 0-15 cm and 15-30cm on each of the two sampling points, The result of the analysis carried out showed that the level of heavy metals were generally higher at surface soils than subsurface soils, with mean values of 1291.08 mg/kg and 1236.9 mg/kg for Iron (Fe), 87.96 mg/kg and 83.28 mg/kg for Lead (Pb), 69.54 mg/kg and 201.94 mg/kg for Zinc (Zn), 11.01 mg/kg and 13.12 mg/kg for cadmium (Cd), 10.61 mg/kg and 13.56 mg/kg for Nickle (Ni), 7.76 mg/kg and 7.42 mg/kg for Copper (Cu) and 1.06 mg/kg and 101 mg/kg for Chromium (Cr) in surface and subsurface, respectively, These results indicates a higher concentration of heavy metals in surface and subsurface soils at waste dumpsites. In this aspect the present study pointed out the pollutants concentration in dumping site, as per the CPCB direction should avoid discharge of waste without segregation and treatment, and it has been observed that high amounts of heavy metals such as Fe, Zn, Pb, Cd, Ni, Cu, and Cr according to the Indian Standards. And indicates percolation of heavy metals into the subsurface soils and contaminate the ground water in and around the waste dumping sites, and there is no proper management of solid waste in the study area.

Key Words: 1.Anthropogenic, 2.Dumping sites, 3.Environment, 4.Heavy metals, 5.Standards.

1. INTRODUCTION

The environmental contaminant is a serious problem in recent years facing human since these metals constitute a hazard to organisms and may cause health problems to the consumers (Vasques, et al., 1993), Municipal solid waste landfills often represent a major environmental problem due to their proximity to inhabited areas. According to Chiemchaisri et al. (2007), the presence of heavy metals in the environment is of great ecological significance due to their toxicity at certain concentrations, translocation through food chains and non biodegradability which is responsible for their accumulation in the biosphere (Aekola et al., 2008). Urban MSW is usually generated from human settlements, small industries and commercial activities (Singh et al., 2011), they require a more serious attention, and one of the major sources of heavy metal in the world is leachate from waste dumpsites. Due to the rapid increase in the population and urbanization, a high degree of generation of solid waste is taking place at a rate faster than they can be evacuated collection and disposal of solid waste has therefore become one of the greatest problems facing today, heavy metals are the metals and metalloids having atomic densities greater than 5g/cm3 (Wild, 1993), At some levels of exposure and absorption, they are harmful to most living things. Heavy metals are released into the environment through anthropogenic activities like domestic, industrial, commercial activities, industrial effluents, pesticides and fungicides as well as from manure, (Ukpong, et al., 2013).

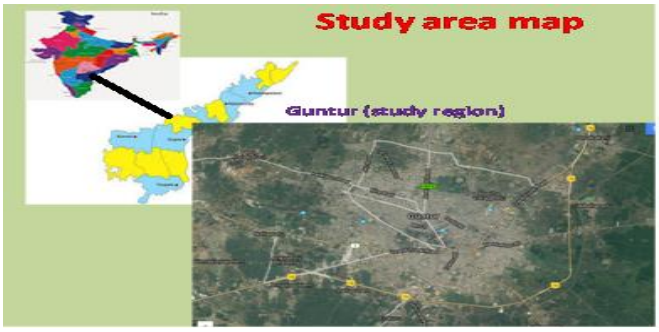
The increasing load of heavy metals has caused imbalance in aquatic ecosystems and the biota growing under such habitats accumulate huge amount of heavy metals (Zn,Cu,Pb,Cr and Cd etc) which in turn, are being assimilated and transferred to humans within food chain (Nuzhat et al 2013), according to Alloway (1996), toxicity sets in when the heavy metal content in the soil exceeds natural background level. This may cause ecological destruction and deterioration of environmental quality, influence yield and quality of crops as well as atmosphere, and health of animal through food chains. Municipal solid waste compositions have had paper, food waste, metal scraps, glass, ceramics, ashes, etc. Decomposition process releases the heavy metal contained in these wastes to the soil of the waste dumpsite thereby contaminating the soil (Ukpong et al., 2013). The aim of this study is to investigate the total content of heavy metals in soil and sub surface soils in selected refuse dumpsite in the study area.

2. MATERIALS AND METHODS

2.1 Study area:

Guntur is a city in the Guntur district, Andhra Pradesh. India (Figure 1). It is situated in Guntur revenue division. The city is a municipal corporation, 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. Thousands of kg releases the solid waste from different regions in the city that has been dumped in the dumping regions which around the Guntur city outs cuts. l. 2

Figure: 1. Study area map



2.2 Sample Collection and Sample Treatment

five soil samples were collected from waste dumpsite in selected points, each soil samples was collected at a depth of between 0-15cm and 15-30cm. five samples were also collected away from the dumpsites, at depth of between 0-15cm, and 15-30 cm, samples were packed in separate bags and taken to the laboratory for analysis.

2.3 Soil Samples:

At the laboratory; the soil samples were air dried and ground to powdery form using a pestle and mortar. The sample was sieved with a 2mm sieve. The soil sample (1g) was weighed into a digestion flask. Concentrated nitric acid (20ml) was added and the mixture was digested using hot plate. After digestion it was allowed to cool and 30 ml of distilled water was added and filtered with Whatman filter paper. The digest was made up to 50 ml solution with distilled water. Then, the digest was use for the determination of heavy metals using atomic absorption spectrometer (AAS).

3. Results and discussion

Heavy metal contents of soil are of major significance because of their non-degradable nature and ability to accumulate for long period of time (Gallego et al., 2002; Wu and Zhang, 2010), Rapid urbanization, industrialization, population explosion, fertilizer and pesticide use have resulted in heavy metal pollution of land and water resources (He et al., 2004, CPBC, 2008). The results revels that Surface soil and sub surface soil samples having heavy metals content in the Sample –I (S1), 1523.2 mg/kg and 1624.8 mg/kg for Iron and the mean value in both samples are 1291.08, 1236.9, and the minimum and maximum values were present in the table 3 and table 4, the graphical representation (Figure 2) shows that the sub surface soils having maximum level of Iron, it indicates percolation of heavy metals into the ground layers. The Lead (figure 9 & 10) maximum contents in all sampling stations of both soil samples the mean values are 87.96 mg/kg, 83.28 mg/kg, minimum values are 74.12 mg/kg and 64.2mg/kg, maximum 110.5 mg/kg and 92.8 mg/kg, the graphical representation (Figure 3) shows that surface soils have maximum content. Similar studies were observed in some sites in Nigeria (Oviasogie and Omoruyi, 2007; Gungshik and Mohammed, 2008; Gungshik et al., 2008). Ultimately, lead enriched in the body of humans through the food chain and endangered their health (Liu et al., 2003). Pb like the other three elements of Zn, Cu and Cd is generally the metal of great concern as well as being phytotoxic while heavy metals like Ni, Pb, Cu, Zn, and Cr were typical entropic elements (Udom et al., 2003). the zinc content in the both surface and sub surface soils the maximum 775 mg/kg is in subsurface soils and the minimum value 41.3mg/kg in the same subsurface soil samples only (table 1 and 2, figure 7, 9 and 10).

The nickel content in the both surface and sub surface soil samples were indicated in Table-1 and 2, figure 4. The maximum and minimum values and the mean values were observe in the figure 9 and 10, the cadmium content mean value in the surface soils is 13.12 mg/kg and in sub surface soils is 11.01mg/kg. Excessive amount of Cd may cause decreased uptake of nutrient elements, inhibition of various enzyme activities, induction of oxidative stress including alterations in enzymes of the antioxidant (Sandalio et al., 2001). the chromium content in the surface and sub surface soils were observed 1.8 mg/kg, 1.9 mg/kg maximum, 0.5 mg/kg minimum and the mean value is 1.06 mg/kg and 1.1 mg/kg (figure 6, 9 and 10, table 3 and 4).the copper content in the surface and sub surface soil samples were observed that the mean values is 7.76mg/kg, 7.42 mg/kg the

minimum values are 6.3 mg/kg, 5.8mg/kg and the maximum content is 9.1mg/kg and 8.7 mg/kg (Figure 8,9 and 10).

Table: 1. Heavy metals concentration in surface soil

	S1	S2	S3	S4	S5
Fe	1523.2	1435.6	1235.8	1185.4	1075.4
Pb	75.34	95.34	110.5	74.12	84.5
Ni	9.58	14.8	12.8	5.1	10.8
Cd	6.58	5.2	9.4	24.8	9.1
Cr	1.4	0.8	0.8	1.8	0.5
Zn	68.3	74.9	66.7	58.3	79.5
Cu	6.3	7.8	9.1	8.7	6.9

Table: 2. Heavy metals concentration in sub surface soil

	S1	S2	S3	S4	S5
Fe	1624.8	1025.4	985.1	1249.5	1299.7
Pb	85.3	85.5	92.8	64.2	84.6
Ni	11.24	22.7	8.4	14.36	11.1
Cd	6.8	8.3	35.4	8.3	6.8
Cr	1.0	0.5	0.6	1.9	1.5
Zn	775	73.2	52.8	41.3	67.4
Cu	5.8	8.3	7.9	6.4	8.7

Table: 3. mean minimum and maximum values of surface soil samples

	Fe	Pb	Ni	Cd	Cr	Zn	Cu
Mean	1291.08	87.96	10.61	11.016	1.06	69.54	7.76
min	1075.4	74.12	5.1	5.2	0.5	58.3	6.3
max	1523.2	110.5	14.8	24.8	1.8	79.5	9.1

Table 4: mean minimum and maximum values of sub surface soil samples

	Fe	Pb	Ni	Cd	Cr	Zn	Cu
mean	1236.9	83.28	13.56	13.12	1.1	201.94	7.42
min	985.1	64.2	8.4	6.8	0.5	41.3	5.8
max	1624.8	92.8	22.7	35.4	1.9	775	8.7

Figure:2. Fe content in both surface and sub surface soil samples

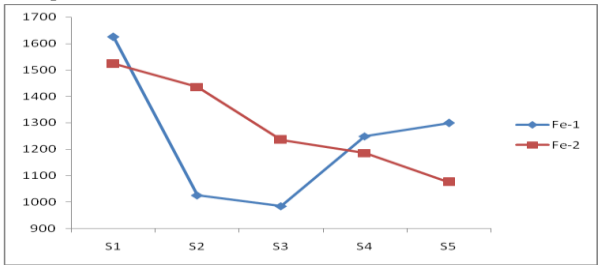


Figure: 3. Pb Content in the soil and sub surface soil samples in the study area

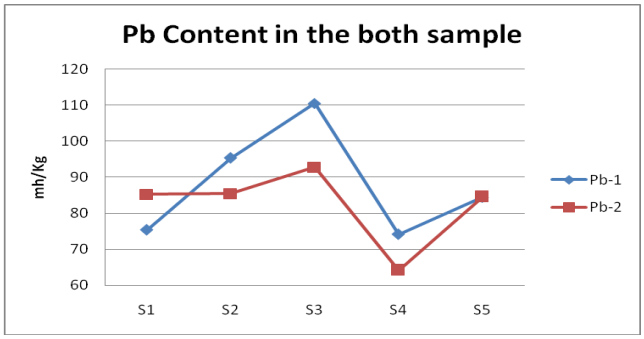


Figure: 4. Ni content in the surface and sub soil samples

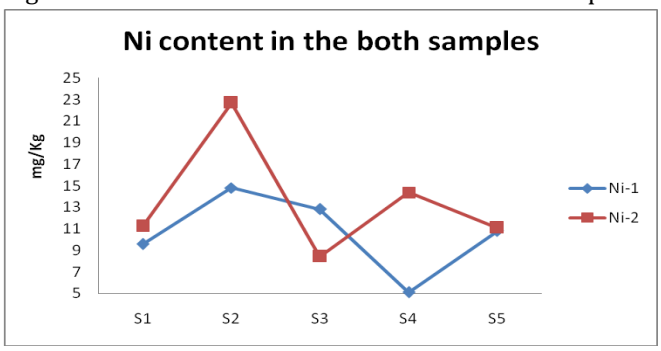


Figure: 5. Cd content in the surface and sub surface soil samples

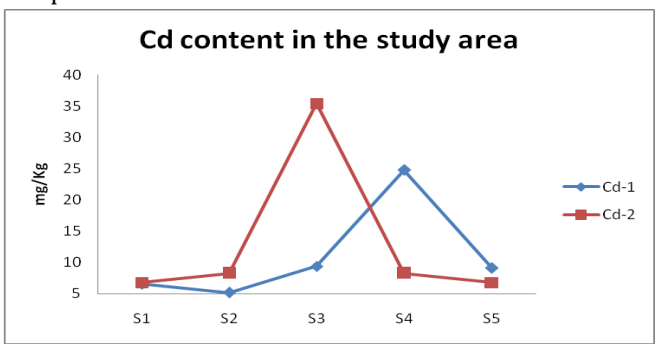


Figure: 6.Cr content in the surface and sub surface soil samples

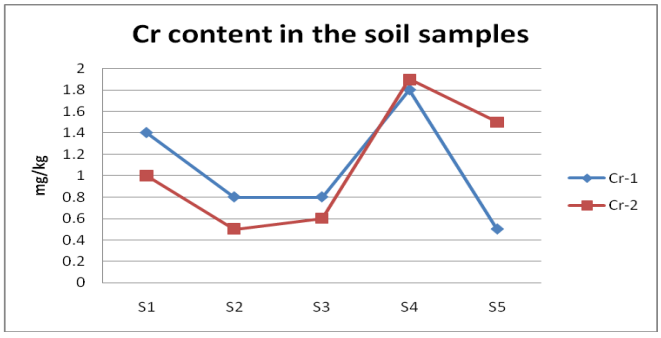


Figure: 7.Zn content in surface and subsurface soil samples

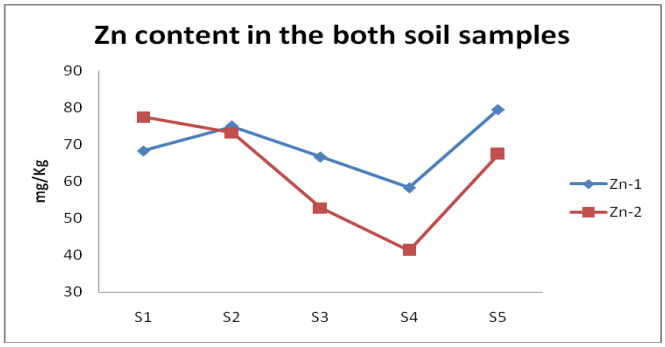


Figure:8. Cu content in the surface and sub surface soil samples

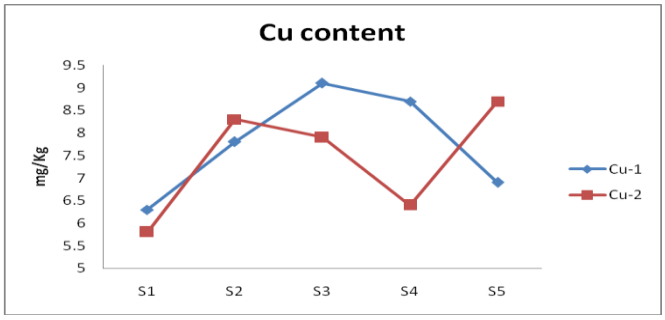


Figure: 9. Min, max and average of heavy metals in the surface soil samples

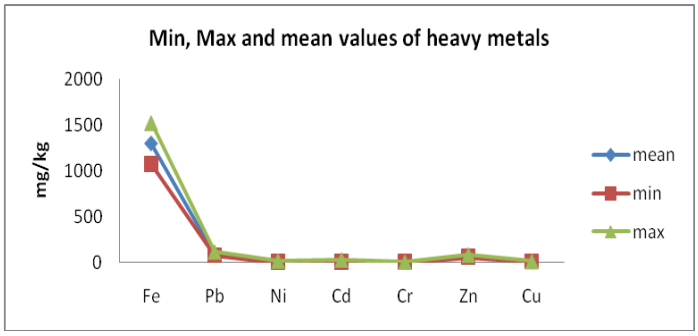
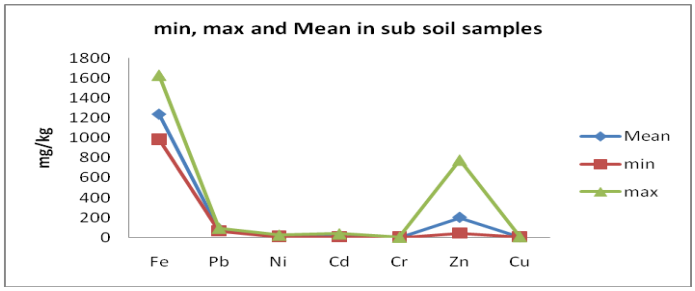


Figure: 10. Min, max and average of heavy metals in the sub surface soil samples



4. CONCLUSION:

The results indicate a higher concentration of heavy metals in surface and subsurface soils at waste dumpsites. In this aspect the present study pointed out the pollutants concentration in dumping site, as per the CPCB direction should avoid discharge of waste without segregation and treatment, and it has been observed that high amounts of heavy metals such as Fe, Zn, Pb, Cd, Ni, Cu, and Cr according to the Indian Standards. And indicates percolation of heavy metals into the subsurface soils and contaminate the ground water in and around the waste dumping sites, and there is no proper management of solid waste in the study area.

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