METAL CONTAMINATION IN URBAN SOILS OF SOME PLAY GROUNDS OF HYDERABAD CITY, TELANGANA STATE, INDIA

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Abstract- The study investigated the environmental attribute of urban play grounds for risk assessment due to heavy metals mobilization into biosphere. Eleven play ground located in the city of Hyderabad were analyzed for the Copper, Zinc, Cadmium and Lead contamination. The research foundation was derived through the experimental observations. Analytical determinations of heavy metals contents were performed by Atomic Absorption Spectrometer. The investigations revealed that the metals mean concentration in the study area The levels of all the metals analyzed are considered to be as all the samples possess their concentration above the minimum values of normal range 6.4-35.42, 37.42- 57.14, 81.2-185.84, 1.6-4.36mg/kg Cu, Pb, Zn and Cd respectively. However ,Cu and Zn values are within the range where as Pb and Cd are considered to be most toxic elements in nature. very high levels of their concentration are alarming
Key words: urban soils, play grounds, heavy metals, AAS

I. INTRODUCTION

In urban environment soil is the natural "sink" of heavy metals from a variety of sources including industrial waste, vehicle emissions and other activities. Trace elements, especially heavy metals, are considered to be one of the main pollutants in the environment, since they have a significant effect on its ecological quality. Due to the continuous urbanization and industrialization in many parts of the world, metals are continuously emitted into the terrestrial environment and pose a great threat to human health. In the past ten years there have been several studies on chemical composition of urban soils in many cities of India. Special attention has been paid to studies of urban park playgrounds. Trace elements in urban environment are able to exert their toxicity through dermal contact, ingestion and inhalation, as a result of the proximity of the soil to and the interaction with the inhabitants of the city. The presence of potentially toxic metals in high concentrations in urban soils has been recognized as an important source of human metal intake particularly in children who are more susceptible to the adverse effects of soil ingestion than adults. Parks and play grounds are where urban children spend most of their free time out of the home and are also places where children most frequently come in contact with soil. Children exposed to contaminated soils, dust and air particulates may ingest a significant amount of toxic elements by putting dirty hands in their mouth", The daily ingestion rates of soil by children have been calculated

to be between 39 and 270mg day. The aim of this study was to investigate the metal distribution in urban soils of the City of Hyderabad. Concentration levels of four potentially toxic elements (Cu, Pb, Zn and Cd) in surface soil samples from the city's playgrounds of Hyderabad were determined.

Urban Geology

Geologically, the city of Hyderabad is situated centrally in a geological province named the Hyderabad granite which dominantly consists of pink and grey granites of early Proterozoic rocks.

The development of Hyderabad city was not properly planned. The roads are too congestive even after road widening. The density of population is very high due to vertical expansion. The percentage of open areas are adequate, however, there are quite large number of open areas found as municipal parks, most of them are not properly maintained, play grounds of educational institutions and public gardens. Most of the open areas along the road side payments are filled with urban waste. The construction activity is seen throughout the year in all areas of the city. The demolition of old buildings and digging of foundation for new buildings and other construction activities are invariably producing large quantities of dust of fine particles which normally transported from one place to another. recent period was considered as a real boom for real estate.

Enhanced nutrient discharge in surface and ground water is expected with urbanization. The major sources of nutrients include and garden fertilizers, septic tanks, leaky sewer lines, urban runoff, and waste disposal sites. High nitrates in the underlying groundwater can pose health risks, especially if the levels exceed the NO_3-N drinking limit of 10mg/L(World Health Organisation,1954)

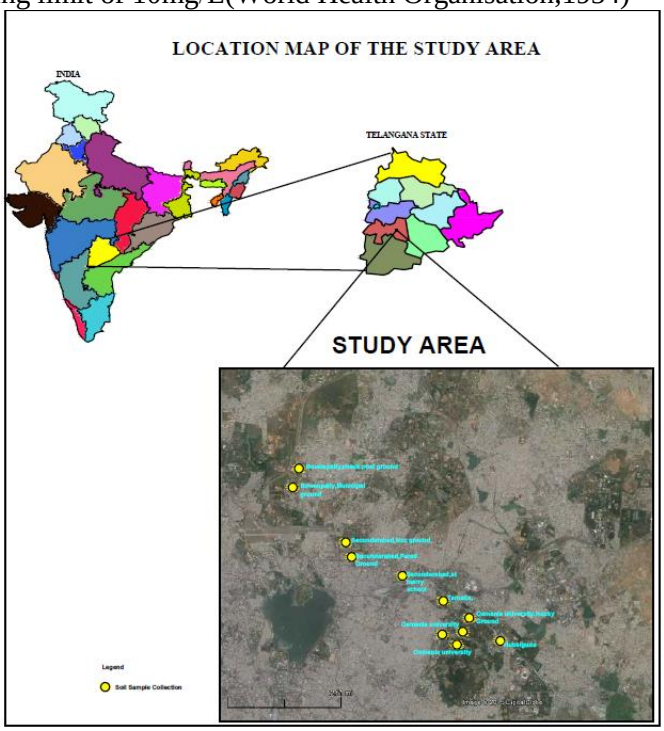

Fig1.Location map of the study area

Material and Methods:

Methodology:

The following basic scientific methodology is followed for attaining the objectives laid for this work:

1. Review and identification of open areas using satellite imageries.
2. Choosing -80 mesh fraction from composite sample collected from each site.
3. Chemical analysis of heavy metals like Cu, Pb, Zn and Cd using Atomic Absorption Spectrophotometer.
4. Adoption of suitable statistical packages and plots for better presentation of results obtained.

METHODS OF STUDY

The study presents the results obtained for the concentration levels of five potentially toxic elements (Cu, Pb, Zn and Cd) in surface soil samples from the city's playgrounds in public parks, playgrounds of Hyderabad. In the study areas, there are no specific point-sources of heavy metals and therefore heavy metal contamination of the soils is resulting from the continuous urbanization and development, which can adversely affect human health in the contaminated area. eleven playgrounds at the different sites in the city were studied

Field work:

11 representative soil samples were collected during field work covering few playgrounds. All the samples were used for the analysis of heavy metal contents. Few samples have been chosen as duplicate samples to check the reproducibility of analysis. Two international standard reference samples (JSD-3, stream sediment of Geological Survey of japan and Geochemical Exploration sample No.2, Soil of USGS) were also used along with other samples for accuracy of the results.

Collection of samples:

Eleven sampling points were selected for this work. At each sample location three sub-samples were collected and mixed thoroughly to make a composite sample of that location. At each location point top layer to the extent of 2-5cm was removed to minimize any organic matter. A 15cm square pit was made to a depth of 10-15cm and the soil was sampled. -2cm size stainless steel sieve was used to remove rubbles and other large particles.

About 2 litre sample was packed in polythene cover and numbered. At each location and type of soil and other physical properties were noted. The location and type of all samples collected were given in table 1. Enough care was taken while sampling the soil to avoid any contamination. A sharp steel sizzle was used to make sampling pits. All the sampling sites were relatively dry.

S.No	Location	Type of Location	Colour
1	Hubsiguda	School Playground	Brownish black
2	Secunderabad	NCC Ground	Red
3	Osmania University	C Ground	Red
4	Osmania University	Hockey Ground	Red
5	Osmania University	A Ground	Red
6	Bowenpally	Check post Ground	Red
7	Osmania University	B Hostel	Brownish black
8	Bowenpally	Municipal Playground	Red
9	Secunderabad	St.Marrys School	Brownish black
10	Tarnaka	Railway Degree College Playground	Brownish black
11	Secunderabad	Pared Ground	red

Table 1.Description of soil samples and their location.

Sampling Preparation:

All the samples were air dried in a cleaned roam. The soil samples used for the study were sieved to pass through a -80mesh. Each time for each sample the pan and sieve were thoroughly washed and cleaned with pressured air to avoid any contamination. All fine fractions were stored independently in numbered plastic tubes for final analysis.

Laboratory Methods:
The determination of metal contents in soil samples involved in two major stages of digestion and extraction, and analysis.

Digestion and Extraction:
All the samples along with replicates and reference standards were accurately weighed, one gram of each, and transferred into graduated test tubes. 5ml of aquaregia was added slowly to each sample and kept them for 12 hours. All the samples were allowed for acid digestion on sand bath at 150^0C for over 4hours with occasional mixing with auto rotator. After normal cooling, each sample was diluted to 20ml with double distilled water and mixed thoroughly. After over night, supernant solutions were transferred into cleaned test tubes for final analysis with Atomic Absorption Spectrophotometer.

Application of Atomic Absorption:
The sensitive of AAS method depend in a complicated way on the optical properties of the atomic vapour, the temperature the relative line widths of lamp and absorber and the geometry of the optical system. Relative detection limits for many elements as determined by flame and furnace AAS are compared. Which includes also comparative data for certain? It will be observed that in general furnace AAS is capable of lower detection limits than flame AAS by a factor of 100 or more. Through there are exceptions such as K, Fe, and Sn, which are about the same in both tabulated detection limits like this must be taken equipment may find quite different values.

Applications of Atomic Absorption:
Atomic absorption is useful in the determination of a large number of metals, especially at trace levels. It is widely used in such fields as water and pharmaceutical analysis and in metallurgy. The exact conditions required for any given determination are quite critical and unless one is prepared to undertake a lengthy methods research it is essential to obtain specific directions and to fallow them care fully.
The major instrument manufacturers provide extensive manuals including procedures for all common metals in a variety of matrices the book by Van Loon (1980) is an excellent source of procedures and general discussion of the principles of AAS analysis.

ANALYTICAL PROCEDURE:
All the digested soil samples along with replicates and standards were analysed for Cu, Pb, Zn, and Cd for their concentrations with recently acquired AAS, Analyst 200, Perkin Elmer housed in the Department of Applied Geochemistry, Osmania University. Pure metals and inorganic salts were used for internal standards as per the specification found in the Reference Manual. Analyst 200 is the latest microprocessor controlled automatic digital display with auto selection of all required parameters for each analysis. All the analysis was performed by an expert. The final results were critically analysed for precision and accuracy. By analogy with the international Standards, the results were found to be satisfactory at 95% confidence level.

DISCUSSIONS

Community gardens in many urban areas pose risk to consumers. Heavy metals and other contaminant assessments are often not done before cities initiate urban garden projects. Suburban areas are mass-graded and topsoil is replaced on the surface. This “soil restoration” decreases infiltration and increases runoff. Over the period the atmospheric pollutants generated due to various activities, will slowly settle to the surface. These pollutants will get washed away during the rainy season from the concrete and road surfaces only where as these get accumulated on the open areas like parks other playgrounds attached to various educational institutes. School going children are the most effected by these pollutants as they spend sometimes in a day in the playgrounds.
Many studies have revealed the effect of pollutants in urban soils on the living habitants. It is, therefore, worthwhile to assess the levels of various toxic elements periodically, to take appropriate remedial measures to curtail any such affects on the human population.
Hyderabad city is one of fast growing urban agglomerations in india. Due to surge in the employment opportunity, especially in the IT sector, identification of “Special Economic Zones” to provide an opportunity for establishing industries and many other reasons influenced for the rapid growth of urban

periphery. It has been noticed that the existing road network is too congestive and it became very difficult to pass through some of the establishment centres. Due to frequent traffic jams more emission of pollutants from the vehicular fuel burning. The pollutants are ultimately fall on the ground and spoil the quality of most urban soils. Indiscriminate dumping of urban waste on the open areas is also one of our major concern. Unless we check periodically the intensity of so called heavy metals in soils, it is very difficult imagine the root cause. The present study is aimed to study the possible metal contamination, as pilot study, in soils of some playground attached mostly to educational institutions.

The work carried out within the context of this provides evidence of the necessity of through soil investigation in order to correctly assess risks from soil contamination with regard to children soil ingestion. It is of course better to be safe than sorry after remediation. Efforts have been carried out, but generalizations and assumptions of unrealistic conditions may results in gross overestimations of risks from soil in take with corresponding costs for society.

Partially extraction concentration of Cu, Pb, Zn, and Cd in playground soils from Hyderabad are shown in Table 2. Table 2 also shows the normal range of their concentrations in soils.

S.no	Cu	Pb	Zn	Cd
1	17.06	38.38	123.96	1.4
2	17.44	41.36	113.76	Tr
3	13.52	47.5	101.38	1.68
4	6.4	37.94	83.56	1.72
5	12.7	39.56	84.02	1.86
6	35.42	56.92	83.22	1.6
7	20.46	53.08	185.84	2.08
8	15.02	37.42	96.5	2.78
9	18.34	43.1	138.48	3.24
10	11.02	57.14	120.02	3.64
11	14.26	43.3	81.2	4.36
Narmal range	2- 250	10-20	1 -900	0.01-2.0

Table2.Metal contents in hyderbad playgrounds(in ppm) along with normal range in soils(after Wedephol,1969)

The levels of all the metals analysed are considered to be high as all the samples possess their concentrations above the minimum values are within the range. However, Cu and Zn values are within the range where as Pb and Cd values exceed their normal range in all soils analysed. The elements like Pb and Cd are considered to be most toxic elements in nature. Very high levels of their concentrations are alarming.

Further, through the analytical is small, it processed statistically to establish any inter-elemental correlations. Table 3 shows correlation coefficients(r) for all the possible pairs. It yielded with out any significant relationships. However, a marginal positive correlation is exists between Cu and Pb (see also Fig.2). The lack significant correlations may be due to non-point source of accumulation of metals in the soils and also the divers mechanisms and pathways and open system of migration and accumulation.

	Cu	Pb	Zn	Cd
Cu	**1.000**			
Pb	**0.508**	**1.000**		
Zn	**0.119**	**0.300**	**1.000**	
Cd	**-0.206**	**0.183**	**-0.033**	**1.000**

Table 3 .Pearson s correlation coefficient(r)matrix.

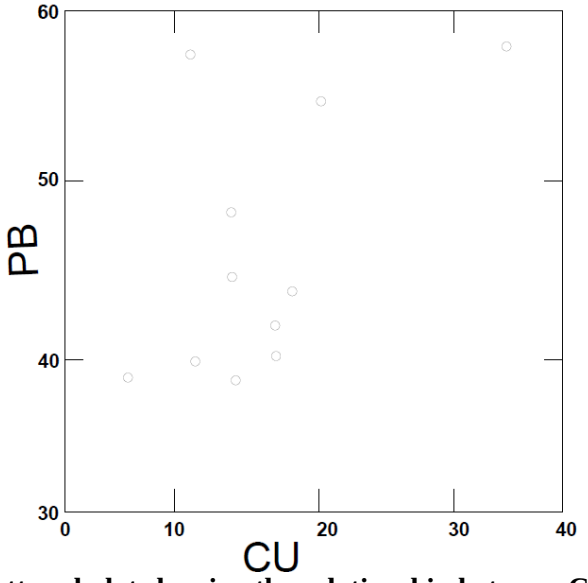

Fig.2.Scattered plot showing the relationship between Cu and Pb.

CONCLUSION

The present work is aimed to assess the concentration levels of some heavy metals in soils of some playgrounds in Hyderabad City as pilot study. The work carried out has certain limitations to make definite conclusions that may be primarily time, extent of area covered and parameters analysed. However, with the scope of present project the following conclusions are broadly drawn.

- It concluded from the survey of existing literature that the topic of project work taken up for this study is the need of the hour.
- With the, sometimes, undue unorganised way of rising urban structures many cities are facing several problems, especially human health and forced to live in unhygienic conditions.
- The quality of soils in terms of heavy metal levels, especially in sampled playgrounds of Hyderabad city shows that the soils have been accumulated considerably at higher levels.
- Finally, it is suggested that a detailed research programme may be worthwhile and also solve the most important social problem to a great extent as many urban areas threaten to exist.

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