Assessment of Some Heavy Metals contamination in Industrial area of Rajnandgaon District , Chhattisgarh

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Abstract

The presence of heavy metals in soil has become a significant global environmental issue due to their harmful impacts on plants, animals, and human health. Metals like lead (Pb), cadmium(Cd),mercury(Hg),chromium(Cr),arsenic(As),iron(Fe),zinc(Zn),Manganese(Mn),Nickel (Ni) etc. find their way into the soil through activities such as industrial operations, mining, poor waste management, the application of chemical fertilizers, and sewage disposal. In contrast to organic pollutants, heavy metals are not easily broken down and tend to accumulate in the soil, causing long-lasting ecological harm. This contamination negatively influences soil fertility, microbial functions, and food safety, as crops can absorb these metals and introduce them into the food chain. Therefore, measuring heavy metal levels in soil is crucial for assessing. Some elements can enter water in the form of oxides ,chloride,carbonates etc. and affect aquatic ecosystem.When these water used as a irrigation purpose then soil becomes contaiminited. The environmental hazards and formulating remediation methods. In the present method 1-(2-pyridylazo)-2 naphtal(PAN) is used as a chromogenic reagent for the trace determination of some heavy metals in the soil samples.

Key words :- PAN, spectrophotometer, pH, soil samples.

Introduction

Soil is   a reservoir of most biological elements in trace quantities. Heavy metals like lead (Pb) and cadmium (Cd), may be tolerated by the ecosystem in low concentrations, but it become harmful at greater concentrations [1].Elevated concentrations of both essential and non-essential heavy metals in the soil can lead to toxicity symptoms and growth inhibition in most plants [2].Smokes from cars contain lead which gets adsorbed by soil particles and is dangerous for plants. The metals , due to their toxicity, stability ,and bio-aggregation, are a serious and hazardousenvironmental contaminant[3,4].Although, fewer than twenty trace elements are required for the growth of plants and animals, the excess concentration of these might be phytotoxic of plants and may have adverse affects on animal health[5,6]. Due to human activities most soils as of rural and urban environments may accumulate one or more heavy metals. The natural content of heavy metals can vary in a large range depending on the material of which of the soil has made of. In fact, heavy metals mobility in the environment depends on their chemical form and type of link[7] accumulation of heavy metals in soil may result in a drop in soil fertility and agricultural production, and even possibly be harmful to human and animal health. Therefore it is necessary to determine the heavy metals at trace levels. The purpose of this study was to examine heavy metal's values in agricultural soil ,industrial soil ,and soil of heavy traffic zone.

Material & Methods
Study Areas

Fig.-Location of Study area

Location & Geographical Area:- Rajnandgaon district is situated in the western part of Chhattisgarh state.It lies between latitude 20°70'- 22°29' North latitude and 80°23' to 81°29' East longitude covering an area of 8222 sq.kms. Its greatest length in the north-south is about 185 kms., while its width in the east-west extends about 80 kms. It is surrounded by Kawardha district in north, Durg district in the east; Bastar district is the south and Garchiroli, Bhandara (Maharashtra) and Balaghat (Madhya Pradesh) districts in the west.

Collections and digestion of Soil Samples

The soil samples were collected from the many industrial areas during the month of January 2025.Samples were collected around $1m^2$ area with a depth of 20cm.During collection remove the grass root, pebbles, stones from the soil and mix thoroughly for homogeneity. The soil samples were collected in polythene bags. Weigh 0.2 gm of soil sample in a beaker and add 15ml of concentrated nitric acid . The solution was heated at temperature not exceeding 120^0C , add 2to 3 drops of H_2O_2 to the solution and boil until it became clear. Nitric acid was added to the solution until there was no residue left in the solution .After that add concentrated sulphuric acid for the removal of plastic in it. Then filter the solution by using Whatman's filter paper no. 43and then transferred the solution in a 100ml volumetric flask[8].The digested solution was used for the determination of heavy metals present in it.

Analysis :-PAN is potentially useful reagent for the separation and determination of some heavy metal ions at different pH ,wavelengths, and formed 1:1 &1:2 metal-ligand coloured complexes[9,10]. The parameters of some heavy metal ions are shown in table 1.

Table 1:- Parameters of heavy metal ions

S. No.	Metals	pH	λ_{max}	Metal-Ligand ratio	Sensitivity, µg/ml/0.001absorbance
1	Pb	7.0	550	1:2	0.005
2	Cu	7.4	550	1:2	0.005
3	Ni	5.4	500	1:2	0.24
4	Mn	7.8	555	1:1 &1:2	0.013
5	Zn	8.0	550	1:2	0.012

Results & Discussion

The concentration of some heavy metal ions are summerized in table 2.

Table2:-Concentraction of Some heavy metals in Industrial Areas of Rajnandgaon District.

S. No.	Heavy metal ions	Rajnandgaon (ppm)	Somni (ppm)	Mohara(ppm)	Gathula(ppm)	Dongargarh (ppm)
1	Pb	0.72	0.54	0.55	0.63	0.86
3	Zn	0.35	1.8	1.2	0.93	1.1
4	Fe	10.2	12.25	10.03	9.12	12.17
5	Cu	1.07	1.02	0.90	0.94	1.07
6	Ni	2.7	2.02	1	1	1

Note:- all data given above are the determinations of five measurements.

Table 3:-WHO Concentration for trace metals in soil(mg/kg)[11]

Metal	Low pollution	Medium pollution	Severe pollution
Pb	36	83	130
Zn	120	290	460
Fe	2000	3000	-
Cu	35	-	-
Ni	23	36	49

Conclusion
Heavy metal ion contamination is one of the most important aspects which influence the ecosystem of our environment. From the given results it clears that Pb, Cu, Zn, Ni and Mn are present in the sample. These metals show toxic potential with injury to human health.

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