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PHYSIOCHEMICAL ANALYSIS OF HEAVY METALS IN SOIL AND GROUND WATER OF INDUSTRIAL AREA PARTAPUR, MEERUT (U.P)

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Abstract: In the present study our aim is to quantify the presence of heavy metals concentration with physicochemical analysis in Soil and Ground water in Pratapur Industrial Area Meerut (UP). The effect of pollution caused by industrial waste and around adjoining areas. The water and soil samples were collected from the five villages around industrial area during the study period from March 2014 to May 2014 (Pre-monsoon). The water was moderately alkaline with high pH. The Ground water and soil quality analyzed for selected heavy metals like Zn, Cu, Pb and Cd, by Atomic Absorption Spectrophotometer. The results were compared with standard values of drinking water prescribed by BIS and WHO. The statistical parameters like mean systematically calculated for physicochemical parameters.

Key Words: Physicochemical parameters, Heavy meals, Surface and Ground water, Statistical Parameter, Atomic Absorption Spectrophotometer.

INTRODUCTION

Partapur Industrial Area is in Meerut district of western Uttar Pradesh, India. It is an industrial area with various factories. It is located about 10 km from the District Headquarter Meerut City. It has its own railway station "Partapur Halt" and a Police Station. It is situated about 40 km from Ghaziabad and about 65 km from India's Capital New Delhi at NH-58.

Industries in partapur Industrial Area:

In recent years, the increasing threat to groundwater quality due to human activities has become a matter of great concern. A vast majority of groundwater quality problems present today are caused by contamination and by over-exploitation, or by combination of both. Rapid urbanization and industrialization in India has resulted in steep increase of generation of wastes. Due to lack of adequate infrastructure, resources and awareness, the waste is not properly collected, treated and disposed; leading to accumulation and infiltration causing Soil and Groundwater contamination. The problem is more severe in and around large cities and in various clusters of Industrial Areas. In many of these areas Groundwater is the only source of drinking water, thus a large population is exposed to risk of consuming contaminated water (Lemo, 2002).

Rapid Industrialization and Urbanization is creating a lot of problems in diverse manners. Primarily, lack of infrastructure and planning wreaks havoc on the environment. The impact of anthropogenic activities on water bodies has been so extensive that they have lost their self-purification capacity to a large extent (Sood *et al.*, 2008).

Table 1:

Name of Industry	Product / Capacity	Hazardous Waste/ Annum
Jyoti Industries, Udyogpuram Meerut	Bed Sheets	0.42 MT
Anupam Processors. Partapur	Dyeing & Bleaching 1500 mt /day	1.5 MT
Olympic Zippers Pvt. Ltd. Partapur.	Polyester Yarn Dying & Weaving	1.2 MT
Olympic Fastner Pvt. Ltd. Ind. Area, Partapur	Polyester Yarn Dyeing & Weaving	1.5 MT
Rachit Prints, Udyogpuram	Bed Sheets 2000	3.6MT
Meerut Agro Chemical Industries Ltd. Industrial Area. Partapur	Formulation of Pesticide Fungicides &Insecticides	0.18MT
Dayal Fertilizers Pvt. Ltd. Delhi Road, Partapur	Micro Nutrient and ZnSo4	6000MT
Avant Garde Carpets Ltd. (Sharda Exports) Partapur Gangol Road,	Partapur Die & Yarn 4000 Kg./day	9.0 MT
Perk Pharma. Ltd. Ind. Area, Partapur	Formulation of Drugs	0.05 MT
Maci Organics Ltd. Ind. Area. Partapur	Formulation of Pesticides Fungicides& Insecticides	0.06MT
Sanjeevni Organics Pvt. Ltd. Achronda, Partapur.	Sanjeevni Organics Pvt. Ltd. Achronda, Partapur.	0.45MT
Mateswari Pesticides, Partapur, Meerut	Formulation of Pesticides	0.15MT
Bharat Agro Molecules, Udyogpuram, Meerut	Ferrous Sulphate	0.25MT
Tirupati Balaji Fertilizer Ind. Udyog puram, Meerut	Zinc Sulphate 5T/day	18 MT
Paswara Impex (P) Ltd., Udyogpuram, Meerut	White Oils	100MT
Allen Oil Corporation, Ind. Area, Partapur	Waste Oil Refining	75MT
Ideal Laminates, Gangol Road, Meerut	Mica Sheets-800Sheets / day	1.2MT

(**Data source:** Regional Office, U.P., Pollution Control Board, Meerut**).**

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Cadmium and Lead are among the metals that cause environmental problems and are among the most dangerous to health (Bryan and Langston, 1992). Cadmium is one of the most toxic metal compound released into the environment (Hadjispyrou *et al.*, 2001). Cadmium can cause cancer; Lead can cause brain and bone damage (WRI, 1987). An estimated 1.3 billion people living in per capita low income countries do not have access to safe drinking water (UNDP-HDR 2006).

Study Area

We have chosen five villages of Partapur Industrial Area for soil and ground water samples. which mostly affected by dumping of Industrial waste and Industrial sludge. Ground Water and soil samples were collected from five villages.

1. Itayra
2. Gagol
3. Kashi gaon
4. Indrapuram
5. Achhronda

MATERIALS AND METHODS

Sample Collection

Polypropylene bottles were used to collect water samples and Polypropylene bags were used for collection of soil samples. Water samples were collected from residential Hand Pumps and govt. Pumps in street of villages. Total 10 water sample were collected from each village. The water samples were collected in sterile plastic bags and transported to laboratory.

Soil samples were collected from nearby field areas, these samples were dig-out form 6 inches below the upper level. Soil samples were conducted from March to May month. Total 10 samples were collected from each village. Soil samples were thoroughly mixed and approx 200 gm. taken in sterile plastic bag and sealed.

DTPA Extraction

Extractions were carried out according to the procedure of Lindsay and Norvell (1978) at 23 +2°C. The Pb, Cd, Cu, and Zn concentrations in the filtrate were determined by Atomic Absorption Spectrophotometer using standards.

Each soil sample is weighed 25 gm and placed in to a 250 ml conical flask and added 50 ml DTPA solution for extraction of metallic ions to be tested. Each water sample is tested as it is and calculated as 100gm in 100gm volume. Testing of samples were carried out by Atomic Absorption Spectrophotometer.

RESULTS

Metal analysis

All analysis conducted by Atomic Absorption Sperctrophotometer (Model AA203-Thermo Fisher Make) Analyses were performed using hollow cathode lamps for copper (Cu), cadmium (Cd), lead (Pb) and zinc (Zn) at the wavelength of 324.8, 228.8, 217.0 and 213.9nm respectively. Air-acetylene flame was generated using a fuel flow rate of 0.8 to 1.1 L min'. All the reagents used were of analytical grade (SRL and Applichem Make).

RESULTS AND DISCUSSION

Table 2:

S. No.	Indrapuram	Itayra	Kashigaon	Gagol	Achronda
Cd	2.522	1.184	0.728	1.588	0.526
Pb	0.698	0.438	0.512	0.588	0.724
Cu	1.05	2.22	0.636	0.972	2.116
Zn	0.636	0.258	0.326	0.144	0.274

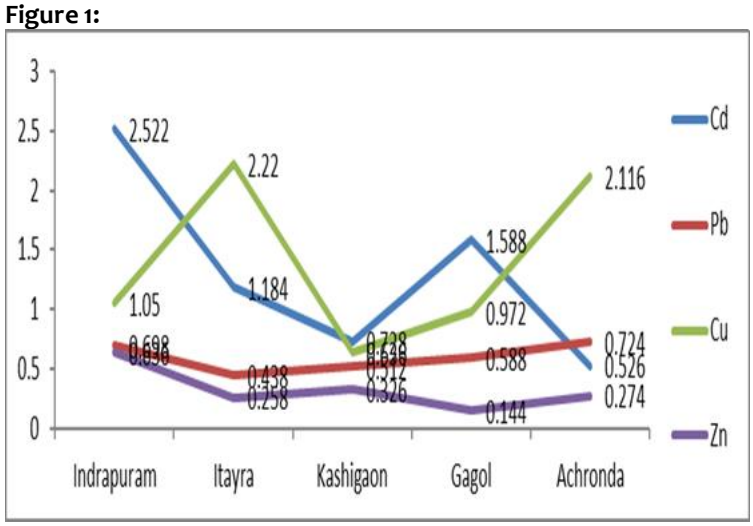
Soil content average results in ppm

Table 2 shows the average concentration of heavy metals present in Soil sample collected from villages around industrial area Partapur. The figure 1 shows Graph of average results. Soil samples collected from industrial area reveal high contamination with Cd (an average 2.52 ppm Indrapuram area).

According to International Programme on Chemical Safety (IPCS, 1992), the permissible limit of Cd in soil samples is 0.2 to 0.5 ppm.

The concentration of Pb was obtained from samples collected from the fields close to industries are within the permissible limit of 15 ppm (Chaney. 1983). The highest concentration comes in Indrapuram area (0.698 ppm)

Figure 1:



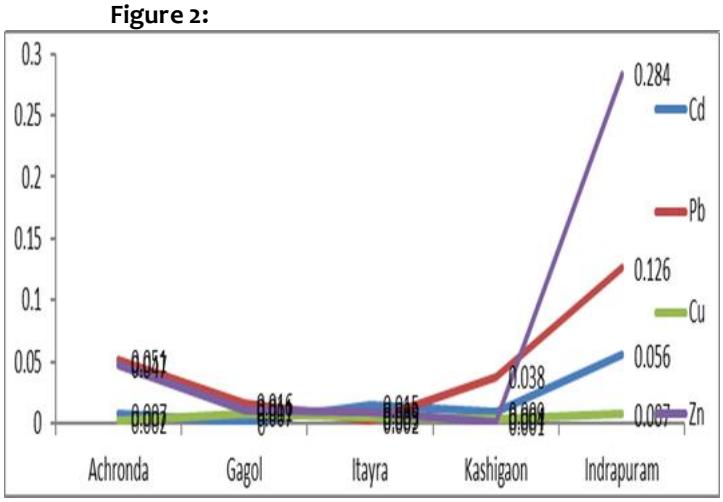
Soil analysis Average results Graph in ppm

Table 3:

S. No.	Achronda	Gagol	Itayra	Kashigaon	Indrapuram
Cd	0.007	0	0.015	0.009	0.056
Pb	0.051	0.016	0.002	0.038	0.126
Cu	0.002	0.007	0.005	0.004	0.007
Zn	0.047	0.011	0.009	0.001	0.284

Water analysis average in ppm

Figure 2:



Water analysis average results (in ppm) Graph

It is evident that the Cadmium content in water is above to the permissible limit 0.01ppm (ISI, 82). The highest concentration observed in Indrapuram Area (0.056 average). The Pb is also above permissible range 0.126 highest in Indrapuram Area. The permissible range of Pb is 0.1ppm (Indian standard Awasthi 2000). Cu is within Permissible range 0.05 (Indian standard) Highest Cu concentration observed in 0.007ppm (Indrapuram Area average). The Zn content is up to the permissible limit 5.0ppm (Indian standard).

pH of Soil

Average pH of Soil Sample collected from villages (Table 4) around industrial area Paratapur Meeurt. The result shows soil samples of Indrapuram is highly alkaline. Alkaline soils are difficult to take into agricultural production. Due to the low infiltration capacity, rain water stagnates on the soil easily and, in dry periods, cultivation is hardly possible without copious irrigated water and good drainage.

Table 4: pH of Soil

S.No.	Village	pH Range
1	Kanshi Gaon	7.22 to 7.65
2	Achhronda	6.87 to 7.23
3	Itayra	6.97 to 7.17
4	Gagol	7.23 to 7.45
5	Indirapuram	7.27 to 8.18

pH of Ground water

Average pH of Ground water Sample collected from villages (Table 5) around industrial area Paratapur Meeurt. High pH highly moderated found in Indrapuram area.

Table 5: Ground Water pH

S.No.	Village	pH Range
1	Kanshi Gaon	7.71 to 7.95
2	Achhronda	7.60 to 8.10
3	Itayra	7.69 to 7.77
4	Gagol	7.6 to 7.70
5	Indirapuram	8.0 to 8.8

CONCLUSION

The analysis of collected soil samples from each village shows variation in heavy element content. The most heavily contamination found in soil of Indrapuram Village. The water is also heavily contaminated in Indrapuram village. The heavy element Specially Pb and Cd contamination in water and soil is there. The villages water were alkaline and contained high amounts of pH Increasing evidence points that elevated metal concentrations in the soil may adversely affect the soil biological and biochemical processes. Agricultural use of pesticides has resulted in the diffuse accumulation of Pb and as in soils (McLaren and Bridge Murray. 1999).

So its obvious that the pretreatment of sewage sludge and the other wastes should be strictly followed by industries before releasing onto the soil, otherwise it results in heavy metal contamination in ground water and soil and ultimately it will give adverse effect to human beings.

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