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Assessment of heavy metal contamination near Parawada (industrial area), Visakhapatnam Dt. (A.P.)

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Analysis of ground water samples (for heavy metals) has been carried out from five sampling stations during the different seasons in 2013 in the vicinity of industries, **[**parawada] Visakhapatnam Dt.(A.P.). The study includes the analysis of parameters such as pH, temperature, copper, chromium cadmium, iron, lead and zinc. It is observed that all the metals reported low concentration as per Indian standards. Hence it can be considered that this water is suitable for both domestic as well as irrigation purposes.

Keyword: Heavy metals - Pollution- Parawada area --Visakhapatnam

1. Introduction

The specific problem of pollution associated with heavy metals in the environment is their accumulation in the food chain and their persistence in nature [1, 2]. The effluents releasing from the mining industry and metal plating factories contain dissolved heavy metals. If these discharges are emitted without treatment, they may have on adverse impact on the environment [3]. The "heavy metals" include chromium (Cr), iron (Fe), cadmium (Cd), manganese (Mn), lead (Pb) and zinc (Zn) are the most toxic to aquatic organisms. Today mankind is exposed to the highest levels in recorded history of lead, mercury, arsenic, aluminum, copper, nickel, tin, antimony, bromine, bismuth and vanadium. Levels of exposure to toxic metals are up to several thousand times higher than in primitive man [1]. Diseases such as renal failure, liver cirrhosis, hair loss, and chronic anemia are apparently related to contaminated drinking water with heavy metals such as Cd, Cr, Cu, Fe, Mn, and Pb. Unlike organic pollutants, heavy metals do not decay, not degradable and thus pose a different kind of challenge for remediation. In view of this, it is proposed to carry out physico-chemical analysis of water samples from parawada industrial area, Visakhapatnam (A.P.).

2. Materials and Methods

The sampling stations selected for the analysis of bore well waters belonging to industries area are: S_1– Venkatapuram -S_2 -Pinamadaka –S_3 – Bhairinkam, S_4– Edulapaka and S_5 –Parawada. The samples collected in 1lt. sterilized bottles were preserved with 2 mL nitric acid to prevent the precipitation of metals. They were then concentrated and subjected to nitric acid digestion. The samples were analyzed during different seasons in 2013. All the chemicals and reagents used were of analytical grade. D.D water was used for the preparation of solutions. Heavy metal analyses were carried out using Atomic absorption spectrophotometer type- SVL Spectronics–205 Model. The pH of water samples was determined by a pH-meter and conductivity was measured by a conductivity meter (Systronics).The results obtained were compared with WHO [4] and Indian standards for drinking water [5].

3. Results and discussion

The results obtained on the analysis of heavy metal concentration recorded at different stations are summarized in Tables – 1 to 4.

A rise in temperature of water leads to the speeding up of chemical reactions in water, reduces the

solubility of gases and amplifies the tastes and odors. The average temperature of the present study ranged from 26.06 - 29.72 ^{0}C.

Acid base reactions are important in ground water because of their influence on pH and the ion chemistry. Higher levels of pH and alkalinity tend to reduce toxicity of metals in water. The pH values of the present investigation were within the prescribed standards (7.0 – 8.5).

Table 1: Heavy metal concentration in water samples (spring season)

Station No.	Temperature (^{0}C)	pH	Cr	Cu	Cd	Fe	Pb	Zn
S1	27.70	7.72	0.022	0.006	0.008	0.052	0.0076	0.035
S2	27.75	7.56	0.019	0.025	0.005	0.035	0.0015	0.022
S3	28.16	7.78	ND	0.019	ND	0.026	ND	0.016
S4	28.52	7.46	ND	ND	0.002	ND	0.0024	ND
S5	27.96	7.80	0.016	ND	0.002	0.041	0.0072	0.042

ND = Not Detectable, BDL = Below Detectable Limit

Table 2: Heavy metal concentration in water samples (summer season)

Station No.	Temperature (^{0}C)	pH	Cr	Cu	Cd	Fe	Pb	Zn
S1	29.70	7.65	0.032	0.008	0.005	0.11	0.019	0.043
S2	29.72	7.85	0.047	0.043	0.003	0.065	0.003	0.059
S3	28.85	7.90	0.025	0.028	0.003	0.049	0.005	0.073
S4	28.92	7.81	0.013	0.036	0.006	0.039	0.029	0.065
S5	28.68	7.78	0.036	0.009	0.004	0.24	0.066	0.052

Table 3: Heavy metal concentration in water samples (rainy season)

Station No.	Temperature (^{0}C)	pH	Cr	Cu	Cd	Fe	Pb	Zn
S1	27.22	7.80	0.020	0.011	0.004	0.068	ND	0.032
S2	27.40	7.72	0.043	0.032	0.002	0.033	BDL	0.038
S3	27.58	7.78	ND	0.021	ND	0.053	0.050	0.065
S4	27.82	7.68	0.008	0.015	0.002	0.024	0.017	0.021
S5	28.06	8.06	ND	ND	BDL	0.15	0.025	0.027

Table 4: Heavy metal concentration in water samples (winter season)

Station No.	Temperature (^{0}C)	pH	Cr	Cu	Cd	Fe	Pb	Zn
S1	27.09	7.65	BDL	BDL	ND	0.052	ND	0.002
S2	27.11	7.89	BDL	BDL	0.046	ND	ND	0.026
S3	27.28	7.80	0.022	0.018	0.038	BDL	0.037	0.044
S4	26.60	7.63	0.038	0.014	0.019	0.019	0.008	0.039
S5	26.06	7.85	BDL	0.023	0.034	0.082	0.034	BDL

Chromium (Cr)
Out of the two forms of chromium [Cr(VI) and Cr(III)] , trivalent one is found to be essential to human beings and animals. It plays vital role in insulin metabolism as the glucose tolerance factor (GTF). Cr (VI) is more toxic than Cr(III). It is also responsible for chrome ulcer and kidney damage [6]. The maximum concentration of Cr(VI) permitted in domestic water supplies is 0.05 mg/lt. Several industries that release chromium in the environment are chlor-alkali, electroplating, leather textiles, dyes, metal finishing, mining and metallurgical operations. Cr content of the present study varied between ND to .0.047 mg/lt.

Copper(Cu)
Copper is both essential and potentially toxic element. When present in excess limit (>1.0 mg/lt) imparts undesirable taste to drinking water and irritates stomach. The values obtained are within the permissible levels recommended by Indian standards [5]. Values of copper are found to range between ND to 0.036 mg/lt.

Cadmium (Cd)
Cadmium can be released to the environment human activities, such as tobacco smoking, mining, smelting and refining of non-ferrous metals, fossil fuel combustion, incineration of municipal waste (especially cadmium containing batteries and plastics), and manufacture of phosphate fertilizers. Cigarette smoking can cause significant increase in the concentrations of cadmium in kidneys [7], Cd content of the present study varied between ND to .0.006 mg/lt.

Iron(Fe)
Iron deficiency is quite common among people throughout the world. However iron exposure results in siderosis [8]. Standards of iron in drinking water are 0.3 mg/lt. In the present study iron content varies between ND and 0.24 mg/lt.

Lead(Pb)
Exposure to lead occurs through gasoline additives, cosmetics, folk remedies and battery/plastic recycling industries. The possible health hazard is associated with lead entering feed ingredients from the soil. Its toxicity is attributed to the fact that it interferes with the normal function of enzymes. Symptoms of lead toxicity are headache, numbness, arthritis, and vertigo [9]. Concentration of lead varied between ND and 0.066 mg/ lt.

Zinc(Zn)
More than 50% of metallic zinc goes into galvanizing steel, but is also important in the preparation of certain alloys Industrial sources containing higher amounts of zinc may cause health problems [10]. The low concentration of zinc in drinking water could be due to the fact that pH of water samples was slightly alkaline and its solubility is a function of decreasing pH. In the current study Zn content varied between BDL to 0.073 mg/lt.

4. Conclusions
In a given situation higher concentration of metals in industrial effluents indicates negligence of industries towards waste-water treatment. But in the present case, analysis of various water samples for metals namely- Cr, Cu, Cd, Fe, Pb and Zn revealed that all the values obtained are of low concentration. Hence, water samples belonging to those places are suitable for human consumption and irrigation purposes. (Tables 1-4).

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