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Analysis of heavy metals in the vicinity of Sriramnagar, Vizianagaram Dt.(A.P.)

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ABSTRACT

Analysis of heavy metals-Cu, Fe, Cr, Mn and Zn in surface waters has been carried out from eight sampling stations in the vicinity of Ferro Alloys corporation (FACOR) Sriramnagar, (Garividi) ,Vizianagaram Dt.(A.P.) An attempt has been made to study the seasonal variations .It was found that concentration of some metals such as Fe, Mn and Cr are found above the permissible levels in summer.

Keywords: Heavy metals, Pollution, FACOR, Sriramnagar, Vizianagaram Dt

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INTRODUCTION

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 are up to several thousand times higher than in primitive man [1]. Most organic substances are degradable by natural processes. However, no metal is degradable. Untreated effluents containing toxic metals from different industries resulting in deterioration of water quality [2].Toxic metals replace nutrient minerals in enzyme binding sites. When this occurs, the metals inhibit, over stimulate or otherwise alter thousands of enzymes. An affected enzyme may operate at 5% of normal activity. This may contribute to many health conditions [3]. Toxic metals may also replace other substances in other tissue structures. These tissues, such as the arteries, joints, bones and muscles, are weakened by the replacement process [4]. They may also support development of fungal, bacterial and viral infections that are difficult or impossible to eradicate until this cause is removed.

In view of the above, it is proposed to carry out the analysis of metals in water samples collected from the surrounding areas of Ferro Alloys Corporation (FACOR), Vizianagaram Dt, AP.

EXPERIMENT

Water samples collected from twelve sampling stations selected for the analysis were given bellow: S_1– C – Type quarter, S_2 – A– Type quarter, S_3 –New two roomed quarter, S_4 – new two roomed quarter, S_5 – Banta water, S_6 – DFN area , S_7 – Palm oil factory, S_8 – B – Type quarter, S_9 – G.P road, S_{10} – Main road (Garividi), S_{11} – Tap water (Garividi), S_{12} – MIG colony. 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 on 15^{th} of each month during June 2009 to May 2010. 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. 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 (1984) and Indian standards (1983) for drinking water.

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RESULTS AND DISCUSSION

The results obtained on the analysis of heavy metal concentrations at different stations are summarized in Tables – 1 and 2.

Table – 1 Changes in pH, Temp and Conductivity of water samples

Stn. No.	Season	Temp (^{0}C)	pH	Electrical Conductivity (mhos/cm)
S1	Winter	28.15	7.16	0.34
	Summer	26.94	7.22	0.384
	Monsoon	28.03	7.41	0.503
S2	Winter	27.83	7.58	0.351
	Summer	28.1	7.74	0.366
	Monsoon	27.3	7.64	0.471
S3	Winter	27.52	8.25	0.342
	Summer	27.4	8.04	0.402
	Monsoon	26.8	7.93	0.394
S4	Winter	27.21	7.27	0.342
	Summe	28.03	7.64	0.352
	Monsoon	27.8	7.58	0.357
S5	Winter	26.92	7.51	0.348
	Summer	27.5	8.05	0.424
	Monsoon	28.2	8.23	0.468
S6	Winter	27.8	8.08	0.409
	Summer	28.12	7.95	0.458
	Monsoon	27.6	7084	0.386
S7	Winter	28.05	7.46	0.344
	Summer	28.32	7.24	0.292
	Monsoon	26.93	7.84	0.362
S8	Winter	27.84	7.53	0.345
	Summer	28.32	7.64	0.360
	Monsoon	27.03	7.61	0.512
S9	Winter	27.42	8.20	0.312
	Summer	27.84	8.44	0.402
	Monsoon	26.8	6.93	0.349
S10	Winter	27.2	7.21	0.342
	Summer	28.03	7.54	0.322
	Monsoon	27.5	7.51	0.357
S11	Winter	26.9	7.21	0.318
	Summer	28.24	8.05	0.296
	Monsoon	27.45	8.21	0.468
S12	Winter	27.8	8.24	0.392
	Summer	28.4	7.95	0.452
	Monsoon	27.7	7.26	0.426

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Table – 2 Average concentrations of metals for water samples

Stn. No.	Season	Cr	Cu	Fe	Mn	Zn
S1	Winter	0.024	0.04	0.031	0.18	0.008
	Summer	0.031	0.026	0.087	0.061	0.021
	Monsoon	0.078	0.063	0.025	0.08	0.072
S2	Winter	0.016	0.021	0.087	0.045	BDL
	Summer	BDL	0.037	0.43	0.020	0.042
	Monsoon	BDL	BDL	0.27	0.033	BDL
S3	Winter	0.062	0.019	0.032	0.062	0.056
	Summer	0.032	0.032	0.047	0.032	0.022
	Monsoon	0.015	0.04	0.029	0.018	BDL
S4	Winter	BDL	0.064	0.064	0.021	0.045
	Summer	BDL	BDL	0.072	0.078	BDL
	Monsoon	0.07	0.052	0.036	0.034	0.032
S5	Winter	0.022	BDL	0.055	0.066	0.058
	Summer	BDL	0.082	0.095	0.025	BDL
	Monsoon	0.046	0.046	0.050	0.042	0.087
S6	Winter	0.063	BDL	0.036	0.035	BDL
	Summer	0.042	0.037	0.11	0.046	0.056
	Monsoon	0.035	BDL	0.057	0.024	0.022
S7	Winter	0.032	BDL	0.041	0.075	0.076
	Summer	0.056	0.051	0.084	0.063	0.021
	Monsoon	0.044	BDL	0.059	0.022	0.058
S8	Winter	0.019	0.023	0.095	0.31	BDL
	Summer	BDL	BDL	0.065	0.046	BDL
	Monsoon	BDL	0.058	0.024	0.077	0.045
S9	Winter	0.036	BDL	0.079	0.059	0.061
	Summer	BDL	0.027	0.059	0.17	0.022
	Monsoon	0.065	BDL	0.051	0.095	0.045
S10	Winter	BDL	0.027	0.029	0.082	BDL
	Summer	0.018	0.045	0.27	0.22	BDL
	Monsoon	0.039	BDL	0.35	0.063	0.066
S11	Winter	0.028	0.033	0.023	0.025	BDL
	Summer	BDL	0.088	0.042	0.073	0.052
	Monsoon	0.026	BDL	0.09	0.056	BDL
S12	Winter	0.037	0.047	0.085	0.053	BDL
	Summer	0.062	0.051	0.068	0.039	0.027
	Monsoon	0.032	0.08	0.058	0.036	0.042

BDL = Below Detectable Limit

Temperature of water is basically important because it effects bio-chemical reactions in aquatic organisms. 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 26.8 - 28.32^{0}C.

It is known that pH of water (6.5 to 8.5) does not has no direct effect on health. 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).

The primary effect of water having high electrical conductivity (EC) on crop productivity is the inability of the plant to compete with ions in the soil solution for water. The higher the EC, the less water is available to plants, even though the soil may appear wet. Water with electrical conductivity less than 0.7 m mhos/cm is considered to be safe. However, in the present study, the conductivity values of water are in the range of 0.216-0.512 m mhos/cm and are suitable for crop production.

Chromium (Cr)

Trivalent chromium is found to be essential to human beings and animals. It plays vital role in insulin metabolism as the glucose tolerance factor. Cr(VI) is more toxic than Cr(III). It is also responsible for chrome ulcer and kidney damage [4]. The maximum concentration of Cr(VI) permitted in domestic water supplies is 0.05 ppm. Sources of contamination of chromium in the environment are chlor-alkali, electroplating, leather textiles, pigments, dyes, metal finishing, mining and metallurgical industries. The ash from thermal plants of burning of coal as fuel in various industries contain significant amount or Cr which seeps through earth and affects the fertility of land. Cr content of the present varied between BDL to 0.078mg/lt.

Copper (Cu)

Since copper is both essential and potentially toxic element, there may be risks to living being if there is too little or too much of copper in the environment. Large doses of copper irritate stomach [5]. When present in excess limit(>1.0mg/lt) imparts undesirable taste to drinking water. The values obtained are within the permissible levels recommended by ISI[8].

Iron (Fe)

Although it is abundant in earth's crust, it is absorbed in different forms at different rates. Iron deficiency is quite common among people throughout the world [6]. However iron exposure results in siderosis (mottling of lungs). . Long term consumption of drinking water with high concentration of iron may lead to liver diseases. Standards of iron in drinking water is 0.3mg/lt.[7]. In the present study iron content was found to vary between 0.024- 0.43 mg/lt.

Manganese (Mn)

It is one of the most important trace elements essential for organisms. Shortage of Mn causes fatness, Glucose intolerance. Blood clotting, skin problems, lowered cholesterol levels and skeletal disorders. Manganese effects occur mainly in the respiratory tract and in the brains.

Symptoms of manganese poisoning are hallucinations, forgetfulness and nerve damage. Manganese can also cause Parkinson, lung embolism and bronchitis [9]. When men are exposed to manganese for a longer period of time they may become impotent. The results of the present study are found to be 0.018-0.31mg/lt.

Zinc (Zn)

Zinc is a very common (23rd abundant) element on earth's crust. Many foodstuffs contain certain concentrations of zinc. Drinking water also contains certain amounts of zinc, which may be higher when it is stored in metal tanks. Low intake of zinc results in growth retardation, immaturity and anemia. Industrial sources or toxic waste sites may cause the zinc amounts in to reach levels that can cause health problems [10]. More than 50% of metallic zinc goes into galvanizing steel, but is also important in the preparation of certain alloys. It is used for the negative plates in some electric batteries and for roofing and gutters in building construction. . The low concentration of zinc in drinking water could be due to the fact that pH of water samples were slightly alkaline and its solubility is a function of decreasing pH. Zn content varied between BDL to 0.087 mg/lt

CONCLUSION

On the basis of the results obtained in the present study, it can be said that water samples were found to be having normal concentrations of metals and fit for irrigation as well as drinking purposes. However, certain samples having higher concentrations of iron, manganese and chromium recorded in summer probably due to scarcity of water in that season.

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