Analysis of heavy metals in the vicinity of FACOR, Vizianagaram Dt.(AP)

A.V.L.N.S.H.Hariharan* and Shaik Lakshman

*Department of Chemistry
GITAM Institute of Science, GITAM UNIVERSITY,
Visakhapatnam – 530 045, INDIA

Abstract

Analysis of ground as well as surface water samples for heavy metals-Cu, Fe, Cr, Mn and Zn has been carried out from six sampling stations in the vicinity of Ferro Alloys corporation (FACOR),Garividi,Vizianagaram Dt.(AP).An attempt has been made to study the seasonal variations. It was observed that during summer season the concentration of some metals like Fe and Cr are found above the permissible levels. Probable reduction of Cr has also been attempted.

Keywords: *Heavy metals, Pollution, Chromium, FACOR, Vizianagaram Dt.*

I. INTRODUCTION

High dosage of heavy metals such as arsenic, copper, chromium nickel, lead and zinc are polluting the environment due to various industrial activities. Untreated effluents containing these toxic metals result in deterioration of water quality [1]. However, no metal is degradable unlike organic substances [2].Toxic metals replace nutrient minerals in enzyme binding sites. When this occurs, the metals inhibit, over stimulate or otherwise alter thousands of enzymes. More over these 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. They may also support development of fungal, bacterial and viral infections that are difficult or impossible to eradicate until this cause is removed [3]. 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), Gravidi, and Vizianagaram Dt. AP.

II. MATERIALS AND METHODS

Six sampling stations were selected for the analysis as mentioned bellow: S_1– A – Type quarter S_2 – B– Type quarter, S_3 – MIG colony, S_4 – Main road (Garividi), S_5– G.P road and S_6 – C– Type quarter. The samples collected in 1lt. sterilized bottles were preserved by adding 2 mL nitric acid to prevent the precipitation of metals. They were then concentrated and subjected to nitric acid digestion. Samples were analyzed on 15th of each month during Feb2019 to Jan 2020. Reduction of chromium from industrial wastes has been done for 17 days during Nov. and Dec. 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 Systronics digital conductivity meter.

III.RESULTS AND DISCUSSION

The results obtained on the physico-chemical analysis and other determinations of water samples belonging to different sampling stations are presented in **Tables – 1 to 4.**

All bio-chemical reactions in aquatic organisms are affected by the temperature of water. A rise in its temperature leads to the speeding up of chemical reactions in water and it reduces the solubility of gases and amplifies the tastes and odors. The average temperature of the present study ranged from 26.15 - 29.52^{0}C.

It is known that pH of water (6.5 to 8.5) does not has no direct effect on health. 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. Electrical conductivity values of water samples in the present study are found in the range 0.342-0.553 m mhos/cm and hence are suitable for crop production (conductivity < 0.7 m mhos/cm is considered to be safe) as per prescribed standards. .

Chromium (Cr)

Trivalent chromium plays vital role in insulin metabolism as the glucose tolerance factor to human beings. Cr (VI) is more toxic than Cr (III). It is solely responsible for chrome ulcer and kidney damage [4]. The maximum concentration of Cr (VI) permitted in domestic water supplies is 0.05 ppm. Various industries contribute significant amount of Cr which seeps through earth when disposed on land and affects its fertility. Cr content of the present varied between BDL to0.072 ppm.

Copper (Cu)

There were cases leading risk to living being as per the dosage of copper in the environment [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 [6]. Cu content varied between BDL to 0.083 ppm.

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 However iron exposure results in siderosis (mottling of lungs) [7]. Liver diseases may occur by the consumption of drinking water with high concentration of iron. Standards of iron in drinking water is 0.3mg/lt.[8]. In the present study iron content was found to vary between BDL- 0.28 ppm.

Manganese (Mn)

It is one of the most important trace elements essential for organisms. Shortage of Mn causes glucose intolerance, blood clotting, skin problems etc .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 vary between BDL -0.067ppm

Zinc (Zn)

Drinking water contains certain amounts of zinc, which will be higher when stored in metal tanks. Low intake of zinc results in growth retardation, immaturity and anemia. Industrial sources may cause health problems with higher amounts of zinc. [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. Zn content varied between BDL to 0.25 ppm.

Reduction of chromium

The results obtained on the analysis of chromium content in the untreated effluent samples were given in Table.3. pH value of present study were varied between within the prescribed limit (7.16-7.68).The TSS and Cr (VI) were found to vary between 25.4 and 39.6 ppm and 52.9 to 66.7 ppm respectively. Attempts were also made to treat the effluent in order to reduce Cr (VI) to Cr (III) using (standard) ferrous sulphate solution. During the process of effluent treatment ferrous iron is converted into ferric hydroxide which forms brown coloration to water. Different volumes of the stock solution were (0.025N) used to repeat the experiment until the optimum condition to obtain minimum chromium content. It was found that 87.0ml of ferrous sulphate is needed for reducing the chromium content from 66.7 ppm to Below Detectable Limit. **(table.4).**

Table.1.Changes in pH, temp. cond. of samples

Stn. No.	Season	Tmp (^{0}C)	pH	Elect. Cond. (mhos/ cm)
S1	Winter	25.15	7.46	0.348
	Summer	28.94	7.62	0.374
	Monsoon	27.03	7.47	0.513
S2	Winter	26.83	7.68	0.351
	Summer	29.14	7.77	0.356
	Monsoon	27.35	7.64	0.476
S3	Winter	26.52	8.15	0.362
	Summer	28.47	8.24	0.438
	Monsoon	27.81	7.94	0.392
S4	Winter	27.44	7.4 7	0.377
	Summer	28.03	7.67	0.372
	Monsoon	27.82	7.58	0.379
S5	Winter	26.52	7.46	0.338
	Summer	28.55	8.02	0.429
	Monsoon	27.82	8.35	0.478
S6	Winter	27.80	8.18	0.416
	Summer	29.52	7.99	0.558
	Monsoon	27.64	7.08	0.482

Conclusions:

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.

Table .2. Avg. concns of metals for samples

Stn. No.	Season	Cr	Cu	Fe	Mn	Zn
S1	Winter	0.015	0.02	0.23	0.038	BDL
	Summer	0.083	0.043	0.13	0.038	BDL
	Monsoon	BDL	0.082	0.09	0.055	BDL
S2	Winter	0.046	0.066	0.05	0.042	0.087
	Summer	0.063	0.036	BDL	0.038	BDL
	Monsoon	0.048	0.037	0.18	0.056	0.056
S3	Winter	0.072	0.019	0.22	0.062	0.044
	Summer	0.042	0.032	0.05	0.032	0.032
	Monsoon	0.019	0.04	0.09	0.018	BDL
S4	Winter	0.053	BDL	0.07	0.035	BDL
	Summer	0.048	0.037	0.21	0.046	0.036
	Monsoon	0.055	BDL	0.05	0.024	0.038
S5	Winter	0.022	BDL	0.15	0.066	0.053
	Summer	0.025	0.036	0.19	BDL	BDL
	Monsoon	0.046	0.046	0.22	0.042	0.067
S6	Winter	0.042	0.023	0.16	0.046	BDL
	Summer	BDL	BDL	0.25	BDL	BDL
	Monsoon					

BDL = Below Detectable Limit

Table.3.Physico- chem. Charcs. of effluents

S.No.	Date	Temp.	pH	TSS	Amt. of Cr (ppm)
1	20/11/19	26.65	7.56	39.4	62.5
2	21/11/19	27.90	7.48	29.5	60.4
3	22/11/19	26.51	7.50	26.7	58.4
4	23/11/19	26.04	7.53	34.5	60.8
5	24/11/19	26.35	7.40	30.8	64.7
6	25/11/19	26.93	7.63	28.3	60.8
7	26/11/19	26.86	7.20	33.3	57.8
8	27/11/19	27.07	7.44	28.9	61.7
9	28/11/19	26.86	7.33	37.6	66.2
10	29/11/19	27.05	7.27	25.4	60.9
11	30/11/19	27.20	7.28	37.6	62.4
12	01/12/19	27.15	7.54	29.8	58.2
13	02/12/19	27.72	7.26	27.2	60.6
14	03/12/19	27.25	7.52	38.6	57.5
15	04/12/19	27.42	7.55	27.9	63.5
16	05/12/19	28.13	7.60	33.6	60.2

Table .4. Reduction of Cr in Samples and industrial wastes

Sample	Iron (II) added (ml)	Cr reduced (ppm)	TSS (ppm)
1	0	34.8	2.6
2	10	24.5	3.5
3	20	21.5	4.8
4	30	19.2	6.8
5	40	14.6	7.4
6	60	11.5	8.2
7	80	7.8	9.6
8	81	5.9	11.5
9	82	3.6	13.3
10	83	1.9	16.6
11	84	0.75	19.0
12	85	0.06	21.5
13	86	0.05	18.8
14	87	0.03	14.2
15	88	BDL	10.6

The extent of pollution due to tannery effluent was decreased by adopting possible method of treatment for chromium and its reduction has been developed. It was noticed that chromium concentration was reduced below the permissible limits.ie. It is evidenced from Table-4 that reduction of chromium (VI) (66.2ppm) to chromium

(III) can be done effectively achieved up to the below detectable limit.

REFERENCES

[1] L .Jarup British Medical Bulletin; 68**,** 2003, 167-182.
[2] R.Petrus and J .K. Warchol Water Res,; 39**,**2005, 819-830.
[3] R.S. Lokhande and N. Kelkar Indian J Environ Protect. 19, 1999, 664-668.
[4] N.K. Verma O.P. Jain and P.K. Srivastava Proc. Acad.Env. Biol. 4(1**)**, 1995, 123-126.
[5] M.R. Bruins S.Kapil and F.W.Oehme Ecotox .Environ Safe, 45**,** 2000, 198-207.
[6] WHO Guidelines for drinking water quality, Geneva, 1984.
[7] R.N. Barik B.Pradhan and R.K.Patel "*Trace elements in ground water of Paradip area*". J Ind. Poll. cotrol .21(2), 2005, 355-362.
[8] ISI Indian Standard Institution 1995 Indian standard for specifications for drinking water.
[9] G .B.Raje D.V.Muley and D.D.Manker .J Ind Poll Contr., 21(2**),** 2003, 381-386.
[10] National research council 1977 Drinking water and Public Health Vol.1 Safe Drinking water Committee, National Academy Press,Washington D.C.