



Analysis of Heavy Metals in the Vicinity of Waltair Sea Coast, Visakhapatnam Dt. (A.P.)

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ABSTRACT

Water pollution is caused by industries as well as other activities etc. Heavy metals such as lead, mercury, arsenic, aluminum, copper, chromium and antimony deteriorate water quality to a large extent. This paper deals with the analysis of heavy metals- Cr, Na, Fe, Mn and Pb in well and bore well waters for a period of 6 months from eight sampling stations in the vicinity of Waltair Sea Coast, Visakhapatnam Dt.(A.P.) The estimated metal levels in the water samples were compared with those limits laid down by WHO standards. It was found that concentration of some metals such as Fe, Na and Cr above the permissible levels in some areas probably due to contamination with impurities.

Keywords: Heavy metals –Pollution- Waltair sea coast -Visakhapatnam Dt.

INTRODUCTION

Toxic metals - cadmium, chromium, copper, nickel, lead and mercury etc. are non-degradable. These metals replace other substances in their tissue structures. These tissues, such as the arteries, joints, bones and muscles, are weakened by the replacement process [1,2]. They may also support development of fungal, bacterial and viral infections that are difficult or impossible to eradicate until this cause is removed. In recent years, industrial activities have been disturbing the geological equilibrium of metal ions through release of large quantities of toxic metal ions into the environment. In view of the above, it is proposed to carry out the analysis of metals in water samples of Waltair sea coast in Visakhapatnam Dt.

MATERIALS AND METHODS

Water samples collected from eight sampling stations selected for the analysis were given below. : S₁ – Waltair depot (Bore Well), S₂ Pedajalaripeta (Bore Well), S₃ – Mithila jalajanani school (Bore Well), S₄ – Vasavanipalem (Bore Well), S₅ – Adarsa gramam (Bore Well & open well), S₆ – Ramalayam street (Bore well & open well), S₇ Balaji nagar. (Bore well) S₈ Vuda park street (Bore Well). The samples collected in 1lt sterilized bottles and were preserved with 2 ml nitric acid to prevent the precipitation of metals. The samples were analyzed on 11th of each month during Oct 2011 to March 2012. 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 digital conductivity meter (Systronics). The results obtained were compared with WHO [3] and Indian standards [4] for drinking water.

RESULTS AND DISCUSSION

The results obtained on the analysis of heavy metal concentration at different stations are summarized in Tables – 1 to 6.

Table 1 Physico – Chemical Parameters of Water Samples Collected on 11-10-2011

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	26.39	7.55	60.3	0.013	0.065	0.16	ND	ND
S2	26.45	7.89	87.5	0.052	0.032	ND	0.018	0.023
S3	27.28	7.80	65.9	ND	ND	ND	0.068	0.052
S4	26.80	7.63	64.7	ND	0.034	0.032	ND	0.029
S5	27.02	7.85	99.0	ND	0.022	0.19	0.045	0.036
S6	27.12	7.82	76.9	0.042	ND	0.039	ND	ND
S7	27.09	8.22	109.1	0.036	0.049	0.27	0.032	0.065
S8	27.12	8.26	92.3	ND	ND	0.06	ND	0.09

ND = Not Detectable

Table –2 Physico – Chemical Parameters of Water Samples Collected on 10-11-2011

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	27.05	7.46	61.4	0.022	ND	0.037	ND	0.006
S2	26.96	7.74	67.5	0.031	ND	0.045	0.022	0.035
S3	27.05	7.89	87.1	0.014	ND	0.050	ND	0.028
S4	27.56	7.80	84.9	0.019	0.023	ND	0.26	0.014
S5	27.52	7.86	67.0	ND	ND	0.035	0.038	ND
S6	27.20	7.72	76.9	ND	0.058	ND	ND	0.039
S7	27.62	8.02	89.2	0.046	ND	0.052	0.050	ND
S8	27.84	8.24	116.4	0.028	0.027	ND	ND	0.022

Table –3 Physico – Chemical Parameters of Water Samples Collected on 11-12-2011

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	27.28	7.91	54.5	0.052	ND	0.05	ND	0.034
S2	27.55	7.88	97.0	0.018	0.052	0.02	0.019	ND
S3	27.63	7.82	67.4	0.023	ND	ND	ND	0.044
S4	27.72	7.41	74.7	0.036	ND	0.37	0.044	ND
S5	26.88	7.78	69.0	0.037	0.073	ND	0.052	0.052
S6	27.62	8.30	82.3	ND	0.066	0.062	ND	0.028
S7	27.59	8.15	99.8	ND	0.048	0.19	ND	ND
S8	27.85	8.25	114.2	0.054	ND	ND	0.028	0.026

Table –4 Physico – Chemical Parameters of Water Samples Collected on 11-01-2012

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	27.64	7.86	57.5	0.032	0.04	0.021	0.015	0.037
S2	27.56	7.75	85.2	0.056	ND	ND	0.066	0.042
S3	28.02	7.86	77.9	0.034	0.06	0.062	0.038	BDL
S4	27.98	7.83	74.7	0.019	ND	ND	0.045	0.019
S5	27.56	7.74	89.5	ND	0.037	0.055	0.026	0.052
S6	27.50	7.49	69.9	ND	ND	0.21	ND	ND
S7	27.23	8.22	110.5	0.036	0.019	0.0329	0.037	0.025
S8	26.92	7.91	98.3	ND	ND	ND	0.032	0.004

Table –5 Physico – Chemical Parameters of Water Samples Collected on 11-2-2012

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	27.80	7.81	60.2	0.025	0.028	ND	0.028	0.050
S2	27.64	7.50	82.9	ND	ND	ND	ND	ND
S3	27.94	7.74	77.5	0.006	0.044	0.032	0.058	0.018
S4	27.86	7.56	58.9	0.022	0.037	0.13	0.026	0.041
S5	27.75	7.82	89.2	0.047	ND	ND	0.018	0.060
S6	27.62	8.02	76.5	0.036	ND	ND	ND	ND
S7	27.58	8.13	119.6	0.062	0.023	0.061	0.042	ND
S8	27.43	8.31	92.2	ND	0.026	0.036	0.035	0.029

Table –6 Physico – Chemical Parameters of Water Samples Collected on 11-3-2012

Station No.	Temperature (0C)	pH	Cl	Cr	Na	Fe	Mn	Pb
S1	28.08	7.72	56.2	0.012	0.023	ND	ND	0.039
S2	28.14	7.46	97.5	0.026	0.048	ND	0.027	0.008
S3	28.01	8.25	75.1	0.053	0.042	0.028	0.038	0.052
S4	27.95	7.72	84.2	0.032	0.063	0.033	ND	ND
S5	27.87	7.80	69.0	0.015	0.025	0.065	0.028	0.032
S6	27.65	7.94	79.0	0.023	ND	ND	ND	ND
S7	28.22	7.56	99.8	0.008	0.056	0.052	0.036	ND
S8	27.96	8.11	102.5	0.031	0.22	0.045	0.021	0.027

It is known that pH of water (6.5 to 8.5) does not have any 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. pH of the water samples in the present study found in the range 7.46- 8.31 which are well within the permissible limit [4].

Chloride (Cl)

Chloride occurs in all types of natural waters. The high concentration of chloride is considered to be an indication of pollution by sewage waste of animal origin. Industries are also important sources of chloride in water. Chloride values obtained in the study are found to be higher (116.4 mg L^{-1}) in S₈ sampling station than other stations.

Chromium (Cr)

Both the forms Cr (VI) and Cr (III) are biologically important. Cr (VI) is more toxic than Cr (III). Trivalent chromium is found to be essential to human beings and animals plays vital role in insulin metabolism as the glucose tolerance factor (GTF). Cr (VI) is responsible for chrome ulcer and kidney damage [5,6]. The maximum concentration of Cr (VI) permitted in domestic water supplies is 0.05 ppm. Other 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 of Cr which seeps through earth and affects the fertility of land. Cr content of the present varied between ND to 0.077 mg L^{-1}

Iron (Fe)

Iron deficiency is quite common among people throughout the world. However iron exposure results in mottling of lungs. Standards of iron in drinking water is 0.3 mg L^{-1} [4]. In the present study iron content varies between BDL to 0.34 mg L^{-1} . The Fe concentration of water is slightly exceeding the drinking water limit of 0.3 mg L^{-1} . Long term consumption of drinking water with high concentration of iron may lead to liver diseases [8].

Manganese (Mn)

It is one of the most important trace elements essential for organisms. Shortage of Mn causes fatness, Glucose intolerance. Manganese effects occur mainly in the respiratory tract and in the brains [9]. It can also cause Parkinson and lung embolism. Chronic Mn poisoning may result from prolonged inhalation of dust and fume. The central nervous system is the chief site of damage from the disease, which may result in permanent disability. Symptoms include languor, sleepiness, weakness, emotional disturbances, recurring leg cramps, and paralysis. Mn is found to vary between ND and 0.078 mg^{-1} .

Lead (Pb)

The possible health hazard is associated with lead entering feed ingredients from the soil. The toxicity of lead is attributed to the fact that it interferes with the normal function of enzymes. Symptoms include abdominal pain, convulsions, hypertension, renal dysfunction, loss of appetite, fatigue, and sleeplessness. Other symptoms are hallucinations, headache, numbness, arthritis, and vertigo [1]. The minimum and maximum lead concentrations varied between ND and 0.065 mg L^{-1} . None of the samples exceeded the relevant prescribed limits for lead in drinking water.

Sodium (Na)

Sodium is an essential element for all the human beings. The level of sodium in water is particularly important to people who have to watch their sodium intake for health reasons a diet high in fresh fruits and vegetables, with moderate amounts of milk and meat or poultry, is quite low in sodium. People who live in areas with high sodium levels in drinking water generally have

higher blood pressure than people who live in areas with lower sodium levels in drinking water. Compounds of sodium such as sodium chloride, if present in excess seriously aggravates chronic congestive heart failure, and ill effects [10]. The values obtained in the present study are well within the prescribed limits.

APPLICATIONS

This study is more useful for knowing quality criteria of water

ACKNOWLEDGEMENTS

Thanks to Principal, GIT and Management of GITAM University for providing necessary facilities.

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