

Examination of The Concentration of Heavy Metals In Ground Water Near The Mahad Industrial Area In Maharashtra, India

Shrikant Kekane

I.C.S. College of Arts, Commerce and Science Khed,
Ratnagiri, (Maharashtra) 415709

Abstract- Because the ground water in the industrial area from Mahad M.I.D.C. is used for drinking and household purposes, it is necessary to undertake an assessment of its quality. The area's groundwater is under a lot of stress, which is being caused by heavy industrialisation and growing urbanisation. Thus, the current study evaluates the groundwater contamination caused by heavy metals while taking this important factor into account. At one-month intervals throughout the year, water samples were taken from wells located throughout the industrial area. The Atomic Absorption Spectrophotometer (Perkin Elmer model No. Analyst 200) was used to identify the heavy metals, which are iron, copper, zinc, manganese, nickel, chromium, cobalt, and lead. The majority of groundwater samples have heavy metal concentrations below the maximum allowable limit, according to a comparison of the results with WHO (1993) and BIS (1991) recommendations.

Keywords- Ground water, heavy metal, industrial effluent, seasonal variation.

I. INTRODUCTION

All biotic groups need water, which is a vital component of life. Water is typically never chemically pure (Agale et al., 2013). Although there are very few pollutants in the water, the aquifer's equilibrium is upset by fast industrialisation, population growth, careless chemical usage, and groundwater exploitation (Ramesh et al., 2014). Toxic substances, living and non-living organisms, and high concentrations of minerals that could be harmful to health should not be present in drinking water. The body naturally contains certain metals that are vital to human health. Zinc, for instance, is a co-factor in more than 100 enzyme activities, and iron helps prevent anaemia. They are referred to as trace metals and typically occur at low concentrations (Harte et al., 1991). Industrial waste or effluents can occasionally seep through the subsurface and reach the ground water table, creating a contaminated pool that alters the chemical composition of the ground water and degrades its natural

quality (Pondhe et al., 1992). When utilised for irrigation, contaminated water has an adverse effect on crop health and soil quality.

II. MATERIALS AND METHODS

Parts of the Raigad district's Mahad M.I.D.C. (Maharashtra Industrial Development Corporation) are included in the study area. The selected area's geographical coordinates are Latitude 18°6'12"N and Longitude 73°28'40"E, with an elevation above mean water level (meters) of approximately 177.5m. It has a semi-tropical climate that is hot and humid for the majority of the year. Summer (June-October), winter (November-mid February), and rainy (June-October) are the three distinct seasons in the study region (mid-February-May). The average annual temperature is 27.2 ° Celsius.

Twenty water samples were taken from the wells located around the industrial area at one-month intervals for a year (April 2015 to March 2016) in order to assess the seasonal change of ground water. These water samples were taken from the well in clear, sterile plastic bottles.

III. RESULT AND DISCUSSION

Table1: Heavy metal concentration in ground water around MIDC Mahad, Maharashtra.

Heavy metal	Summer	Monsoon	Winter	Mean
Iron(mgL ⁻¹)	0.061	0.063	0.064	0.063
Zinc(mgL ⁻¹)	0.038	0.034	0.038	0.037
Copper(mgL ⁻¹)	0.033	0.034	0.056	0.041
Manganese(mgL ⁻¹)	0.060	0.019	0.011	0.030
Nickel(mgL ⁻¹)	0.039	0.029	0.024	0.030
Chromium(mgL ⁻¹)	0.042	0.018	0.025	0.028
Cobalt(mg L ⁻¹)	0.009	0.006	0.009	0.008

Table2:Month-wise periodical changes in heavy metals concentration of ground water around MIDC Mahad, Maharashtra.

Heavy metal	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Jan	Feb
Fe(mg L ⁻¹)	0.074	0.065	0.045	0.072	0.064	0.063	0.057	0.058	0.059	0.064	0.066	0.067
Zn(mg L ⁻¹)	0.037	0.042	0.036	0.034	0.031	0.033	0.035	0.039	0.038	0.039	0.038	0.037
Cu(mg L ⁻¹)	0.059	0.008	0.031	0.018	0.013	0.01	0.06	0.069	0.054	0.054	0.057	0.058
Mn(mg L ⁻¹)	0.025	0.073	0.081	0.041	0.025	0.02	0.012	0.002	0.001	0.01	0.021	0.034
Ni(mg L ⁻¹)	0.026	0.047	0.043	0.043	0.034	0.024	0.022	0.021	0.025	0.02	0.021	0.028
Cr(mg L ⁻¹)	0.036	0.048	0.042	0.025	0.021	0.005	0.013	0.026	0.027	0.02	0.029	0.044
Co(mg L ⁻¹)	0.009	0.006	0.012	0.008	0.005	0.004	0.006	0.006	0.007	0.01	0.01	0.009

Iron:

The average iron concentration in ground water during the summer, monsoon, and winter seasons was 0.061, 0.063, and 0.064 mg L⁻¹. The range of concentration observed was 0.045 to 0.074 mgL⁻¹. Due to the natural presence of iron oxides in laterite soil and the leaching of industrial wastes during the rainy season, greater concentrations of iron in ground water were reported during the monsoon and winter (Thomas et al., 2011).

Zinc:

In the monsoon season, the average concentration of zinc in ground water was 0.034 mg L⁻¹, In the winter mean value observed was 0.038mg L⁻¹. In the summer zinc was with a mean value of 0.038 mg L⁻¹. Zinc was ranged from 0.031 to 0.042 mgL⁻¹.

According to Madhukar et al. (2013), the current study found that the concentration of zinc was lower during the monsoon season because of the diluting effect of rainwater, and higher during the summer and winter because of the concentration effect of metals and the depletion of water (Thomas et al., 2011).

Copper:

Since water is typically more harmful to aquatic fauna at lower alkalinities, the toxicity of copper to aquatic life depends on the alkalinity of the water (Train, 1979). The copper concentration presents in ground water ranged from 0.008 to 0.069 mg L⁻¹.The mean values during summer, monsoon and winter seasons were 0.033,0.034 and 0.056 mgL⁻¹, respectively.

Manganese:

The mean manganese concentration in ground water during the summer, monsoon, and winter seasons was 0.060, 0.019, and 0.011 mg L⁻¹, respectively. The concentrations in

ground water ranged from 0.00 to 0.081 mg L⁻¹. According to the current study, groundwater manganese concentrations are greater in the summer and steadily decline until the winter. Manganese compounds are found in the environment naturally as tiny particles in water and solids in soil. Usually, these settle as dust particles on the ground. By burning fossil fuels and engaging in industrial activities, humans increase the concentration of manganese in the atmosphere (Deshpande et al., 2013).

Nickel:

Stainless steel, non-ferrous alloys, and super alloys that are immediately released from these steel industries are the primary uses for nickel. Nickel concentration in ground water varied from 0.02 to 0.047 mg L⁻¹ with a mean value of 0.039 mg L⁻¹ during the summer, and with a mean value of 0.029 mg L⁻¹ during the monsoon season, with an average value of 0.024mgL⁻¹ in winter.Because of the presence of water-soluble salts (Kumar et al., 2001) and the leaching effect of heavy metals, the majority of water samples have concentrations of nickel in ground water that are higher than the allowable limit for drinking purposes (BIS, 1991; WHO, 1984). This leads to an excess of that metal in the ground water (Bharti et al., 2013). Generally speaking, low pH also promotes the concentration of soluble and exchangeable nickel (Parth et al., 2011).

Chromium:

With mean values of 0.042, 0.018, and 0.025 mg L⁻¹, respectively, the seasonal variation of chromium in ground water during the summer, monsoon, and winter seasons the range observed for chromium metal was 0.005 to 0.048 mg L⁻¹. The concentration of chromium in the samples is below the maximum allowable level during the summer.

Due to a variety of human activities, industrial effluents, outdated plumbing and household sewage systems, the discharge of nearby industries, such as chemical manufacturing and tanneries, as well as a significant amount of specific matter in the canal, chromium was retained as adsorbed ions (Mandol et al., 2011).

Cobalt:

During the summer, monsoon, and winter seasons, the cobalt concentration in ground water ranged from 0.004 to 0.012 mg L⁻¹ with an average of 0.009 mg L⁻¹, 0.006 to 0.008 mg L⁻¹in each season respectively. Due to significant rainfall, the concentration of cobalt in ground water is lower during the

monsoon season than it is throughout the summer and winter (Mondol et al., 2011).

Lead:

Throughout the year, no water sample had a lead content.

IV. CONCLUSION

According to the analytical data, the majority of the water samples had concentrations of heavy metals below the allowable level and nickel over the BIS and WHO-recommended allowed limit in groundwater. However, this study highlights the necessity of routine groundwater quality monitoring to periodically evaluate pollution activity and discuss suitable management measures in time to reduce the intensity of pollution activity. Therefore, the following advice should be considered in order to prevent excessive levels of Fe, Mn, Zn, Cu, Ni, and other ions from entering groundwater.

V. ACKNOWLEDGEMENT

The Department of Chemistry I.C.S. college of Arts, Commerce and Science in Khed Maharashtra for motivating the me to do the study of water samples.

REFERENCES

- [1] Agale, M.C., N.G. Patil and A.G. Patil (2013). Impact of sugar effluents on quality of ground water from Dahiwad Village, Dist- Dhule (M.S.). *Scholars Research Library*, **5(2)** :58- 60.
- [2] Bharti, P.K., P. Kumar and V. Singh (2013). Impact of industrial effluents on ground water and soil quality in the Vicinity of industrial area of Panipat city, India. *Journal of Applied and Natural Science*, **5(1)** : 132-136.
- [3] BIS (1991). *Bureau of Indian Standards IS: 10500*, Manak Bhavan, New Delhi, India.
- [4] Harte, J., Holdren Cheryl, Schneider Richard and Christine Shirley (1991). *Toxics A To Z : A Guide To Everyday Pollution Hazards*, Berkeley, CA: University of California Press, pp.103.
- [5] Kumar, S., R. Kushwaha, S. Sarpa, A.B. Gupta and A. Bhargava (2001). Impact of textile industry on ground water quality of Sanagar, Jaipur. *Journal Indian Water Work Association*, **33(4)**:321-326.
- [6] Mondol, M. N., A. S. Chamon and B. Faiz (2011). Seasonal variation of heavy metal concentration in water and plant sample around Tejgoan industrial area of Bangladesh. *Journal of Bangladesh Academy of Science*, **35(1)**:39- 41.
- [7] Parth, V., N.N. Murthy and P.R. Saxena (2011). Assessment of heavy metal contamination in soil around hazardous waste disposal sites in Hyderabad city, India. *Journal of Environmental Research and Management*, **2(2)**:27-34.
- [8] Ramesh, K. and L. Elango (2014). Impact of ground water quality from industrial East coastal town, Southern India. *International Journal of Engineering Research and Application*, **4(1)** : 346-354.
- [9] Thomas, D.R., B. Sunil and C. Latha (2011). Physico-chemical analysis of well water at Eloor industrial area. *Current World Environment*, **6** :259-264.
- [10] Train, R.E. (1979). *Quality criteria for water*. Washington: UAEPA, pp.256.
- [11] Warmate, A.G. and T.J.K. Ideriah (2011). *J. of Ecology and the natural environment*, **3(2)** : 54-57.
- [12] WHO (1984). *Guidelines for drinking water quality*, World Health Organization, Geneva.