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Appraisal of Toxic Heavy Metals in Groundwater at Suburban Area nearby Major Industrial Regions of Jaipur

Dr. Vijendra Singh*

Assistant Professor, Rajkiya Mahila Snatakottar Mahavidyalaya, Kandhla, Shamli, Uttar Pradesh

Abstract – Toxic Heavy metals contamination has been documented as a key environmental alarm due to their occurrence and diligence. These toxic heavy metals like As, Cd, Cr, Fe, Mn & Pb were not found in any studied groundwater samples whilst Cu (0.00 – 0.20 mg/L) found only in sample G2 & Ni (0.00 – 0.02 mg/L) were below recommended values. Only Zn (0.30 – 17.45 mg/L) was exceeded the ISI permissible limit for potable water in samples G2 & G3. Overall findings indicated that groundwater bodies at residential area nearby major industrial areas of Jaipur city were good and to be used as potable water except samples G2 and G3.

Keywords: Trace Metals, Groundwater, Water Pollution, Pre-Monsoon, Residential Areas and Industrial Areas.

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INTRODUCTION

India, being the cradle of one of the oldest civilization, has a long history of exploration and use of groundwater resources. Even in those days it was known that groundwater is more pure than surface water and hence better for drinking purpose. The quality of groundwater used for above purposes is more important as the case of quantity. At present, environmental protection is the main need of the society. It is now an accepted fact that environmental pollution leads to a depletion of the natural resources[1]. In India, too, the environmental pollution has become a cause of concern at various levels. Heavy metals are voluntarily transportable in atmosphere and collect in flora and fauna[2]. Excessive levels of toxic heavy metals in groundwater have detrimental health risk to humans and posed environment stresses. Water sources may be contaminated by heavy metals owing to the incomplete treatment and may not be acceptable for drinking purposes.

Trace metals such as Fe, Zn, Co, Cu and Mg are known as essential micronutrients for normal healthy growth of any organism, while on the other hand the metals such as As, Cd, Hg, Se, Pb, etc. have inherent toxicity to plants and animals[3]. However, these elements are also reported toxic to any organism if exposure levels are sufficiently high[4].

STUDY AREA:

Jaipur is undergoing speedy urbanization and industrialization. The wastewater generated from diverse industries is proposed to be subjected to primary and secondary treatment at the individual industry itself. Number of large, medium & small scale running units is 19,592 in this city. The areas under study were major industrial areas and its flanking spots. Almost all parts of Jaipur city and adjacent areas, a large number of industries have came up during last two decades like Sitapura, Sanganer, Vishwakarma, Jhotwara, Sudershanpura, Bais Godown, Malviya industrial areas, etc. are majorly polluting various water possessions. Some of them industries are situated inside the city and others are outside but all are not free from human residential localities. Although, waste water specially sewage water were accounted to be positive for enhancing crop production and diminish fertilizer necessity but few other studies showed that metals like Cu, Cd, Cr enter in the food chain through their application in soil and this ultimately causes health concern significantly. So the present study is intended to characterize the wastewater of industries in terms heavy metals.

METHODS AND MATERIALS

Underwater samples were collected from 09 unlike industrial spots of Jaipur city. High–density, pre–sterilized, properly labeled polypropylene bottles were utilized for sampling water samples and

examined in laboratory for trace metals by Atomic Absorption Spectrophotometer (AAS). For the assessment of water quality, monitoring was done during post–monsoon session. High AnalR grade, best quality chemicals and dual distilled water was used for preparing solutions for examination of water samples. Water samples were persevered and examined based on the standard methods advised by American Public Health Association (APHA)[5]. Heavy metals like As, Cd, Mn, Ni, Cr, Cu, Fe, Pb & Zn) were examined.

The results of analysis of the heavy metals from nine locations for the pre–monsoon season are presented in Table 1 and discussed in light of the different standards for drinking water set by USPH, WHO and BIS–1999 recommended health based guidelines.

Table 1:

Heavy Metals Concentration of Groundwater of Jaipur City

Site Code	Seasons	Cr	Cu	Cd	Mn	Ni	Pb	Fe	As	Zn
G1	Pre – Monsoon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	01.06
G2	Pre – Monsoon	0.00	0.20	0.00	0.00	0.02	0.00	0.00	0.00	11.38
G3	Pre – Monsoon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.45
G4	Pre – Monsoon	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	00.57
G5	Pre – Monsoon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	01.04
G6	Pre – Monsoon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	04.97
G7	Pre – Monsoon	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	00.74
G8	Pre – Monsoon	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	00.63

RESULTS AND DISCUSSION

In the present study, As, Cd, Cr, Fe, Mn and Pb were not detected in the pre-monsoon season. Arsenic contamination in groundwater imparts ill effects on health of people. It is toxic even at a very low concentration. Consumption of excess quantity of arsenic causes damages to human health like renal, carcinogenic, neurological, hepatic, hematological, respiratory[6], etc. The drinking water having more than 0.1 mg/L of cadmium can cause bronchitis, itai–itai, anemia, renal stone formation, hypertension and arteriosclerosis in animals and human[7 – 8]. According to WHO, the level of hexavalent chromium in potable water should not be higher than 0.05 mg/L. It causes dermatitis, ulceration, lung cancer and perforation of nasal septum. Concentrations of iron in drinking water are normally less than 0.3 mg/L. The permissible concentration of manganese in drinking water has been recommended below 0.005 mg/L. Manganese is not toxic metal, but at excessive concentration, it affects the central nervous system, causes gait and speech disturbance tremors, uncontrollable laughter, lung troubles. Excess intake of lead creates dullness, restlessness, irritability, headaches, kidney damage, loss of memory, brain damage, lower IQ and can also lead to death. Although, all above heavy metals were totally absent in all studied samples.

Copper was only found in sample G2, its maximum values was detected in pre–monsoon season (0.2 mg/L). The ingestion of acute toxic levels of copper may result in nausea, vomiting, diarrhoea, jaundice, extensive lever damage, hypertension, coma, hemoglobinuria and hematuria[9– 10]. Nickel in samples G1, G3, G5 & G6 were absent but in samples G2, G4, G7 & G8, it varied from 0.01 to 0.02 mg/L. The maximum concentration of nickel was found in pre–monsoon season of sample G2 & G8. The oral administration of large dose of nickel salts may cause gastrointestinal irritation, diarrhoea, vomiting, development of gastrointestinal and neurological disorder. The normal intake of nickel per day varies between 0.3 and 0.6 mg.

Only zinc was discovered in all samples and ranged between 0.30 and 17.45 mg/L. Zinc imparts an undesirable astringent taste to water. Excessive zinc consumption is linked to damaged pancreas, muscular stiffness, nausea and anemia. Its maximum concentration was monitored in pre–monsoon season.

It is concluded that the water samples from the various areas, during all the period of monitoring have been found to contain all trace metals below permissible limits except Zinc. In other words, there are not large variations in the concentrations of heavy metals like Cu & Ni in drinking water from different sites, while As, Cd, Cr, Fe, Mn and Pb are totally not in attendance in all studied samples. It is interesting to note that in all the studied samples, the trace metals are present in very low concentrations except Zinc. Zinc has cumulative effect and its consumption is linked to damaged pancreas, muscular stiffness, nausea and anemia. Due to these reasons, its presence is unacceptable in the domestic water supply. Overall findings indicated that groundwater bodies at residential area nearby major industrial areas of Jaipur city were good and to be used as potable water except samples G2 and G3 without prior treatment. Vijendra Singh and co-workers has studied the water quality in wastewater in Jaipur city recently[11 – 13].

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REFERENCES

1. Mathur Om Prakash (1994). Urbanizations, Poverty and Environment, Prepaired for

the World Resources Institute, Washington D.C.

2. Leita L. and De Nobili M. (1991). Water Soluble Fraction of Heavy Metals During Compositing of Municipal Solid Waste., J. of Envir. Qual., 20, pp. 73–78.

3. Olaniya M.S. et. al. (1998). Heavy Metal Pollution of Agricultural Soil and Vegetation due to Application of Municipal Solid Waste – A Case Study, I. J. Environmental Health, 40(2): pp. 160–168.

4. Sharma M.S. and Selvaraj C.S. (1994). Zinc, Lead and Cadmium Toxicity to Selected Freshwater Zooplankters, Poll. Res., 13, pp. 191–199.

5. APHA, AWWA and WPCF (1989) Standard Methods for the Examination of Water and Waste Water, edited by Lenore S. Clesceri, 17th ed., Washington DC.

6. Mido Y. and Satake M. (1995). Chemicals in the Environment, 1st Edi., Discovery Publishing House, New Delhi.

7. Solanki H.A. and Pandit B.R. (2005). Study of Some Heavy Metals (Arsenic, Cadmium, Chromium, Lead and Mercury) in the Ponds Water of Vadodara, Gujrat State, India, Ecol. Env. & Cons., 11(1), pp. 99–100.

8. WHO, Guidelines for Drinking Water Quality, Vol. 2, Geneva (1988).

9. Patnaik, K.N., Satyanarayana, S.V. and Swoyam Poor Rout (2002). Water Pollution from Major Industries In Pradip Area – A Case Study, Indian J. Environ. Health, 44(3), pp. 203–211.

10. Arnikar, Kadam H.S. and Gurjar K. (1992). Essentials of Physical Chemistry and Pharmacy, Orient Longman Ltd, New Delhi, India.

11. Vijendra Singh (2017). Characterize the quality of wastewater of Amanishah Nala of Jaipur city. Scholarly Research Journal for Interdisciplinary Studies. 4/34, pp. 40-49.

12. Vijendra Singh (2017). Assessment of Fluoride Contamination in Industrial Waste Water and Ground Water of its Suburb Areas of Jaipur. International Journal for Environmental Rehabilitation and Conservation. VIII/2, pp. 77-81.

13. Vijendra Singh (2017). Estimation of Heavy Metals in Groundwater at Residential Area Nearby Major Industrial Areas of Jaipur City. International Journal for Environmental Rehabilitation and Conservation. VIII/2, pp. 82-87.

Corresponding Author

Dr. Vijendra Singh*

Assistant Professor, Rajkiya Mahila Snatakottar Mahavidyalaya, Kandhla, Shamli, Uttar Pradesh

vijendrsingh@gmail.com