International Journal of Advanced Research in Chemical Science (IJARCS)
Volume 2, Issue 12, December 2015, PP 47-53
ISSN 2349-039X (Print) & ISSN 2349-0403 (Online)
www.arcjournals.org

Microdetermination of Trace Metal Ions Contamination of Water Samples by Using AAT

S. M. Bombatkar[a*], G. H. Murhekar[b], A. R. Raut[a]

[a]Government Vidarbha Institute of Science And Humanities, Amravati, 444604 (M.S.), India
[b]Department of chemistry, Dr. R. G. Rathod Arts and Science College, Murtizapur, India.
gopalmurhekar@gmail.com

Abstract: *The microdetermination of Trace metals contamination of water samples from various water samples were collected and was assess. The sampling points were selected on the basis of their importance. The heavy metals like Al, As , Co, Pb, Cu, Ni and Zn were analyzed in water samples of various chemical laborites, industries and two tanks . The results were compared with standards prescribed by WHO. It was found that the water was contaminated. Some sampling sites showed trace elements contamination above the water quality standards and the quality of water is very bad and it is unfit for drinking purpose.*

Keywords: *trace metals, microdetermination, contamination, WHO.*

1. INTRODUCTION

Water plays a vital role in human life. Natural resources are the important wealth of our country, water is one of them. Water is a wander of the nature. *" No life without water "* is a common saying depending upon the fact that water is the one of the naturally occurring essentional requirement of all life supporting activities[1] Since it is a dynamic system, containing living as well as nonliving, organic, inorganic ,soluble as well as insoluble substances. So its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. The availability of water through surface and groundwater resources has become critical day to day. Only 1% part is available on land for drinking, agriculture, domestic power generation, industrial consummation, transportation and waste disposal.[2,3,4]

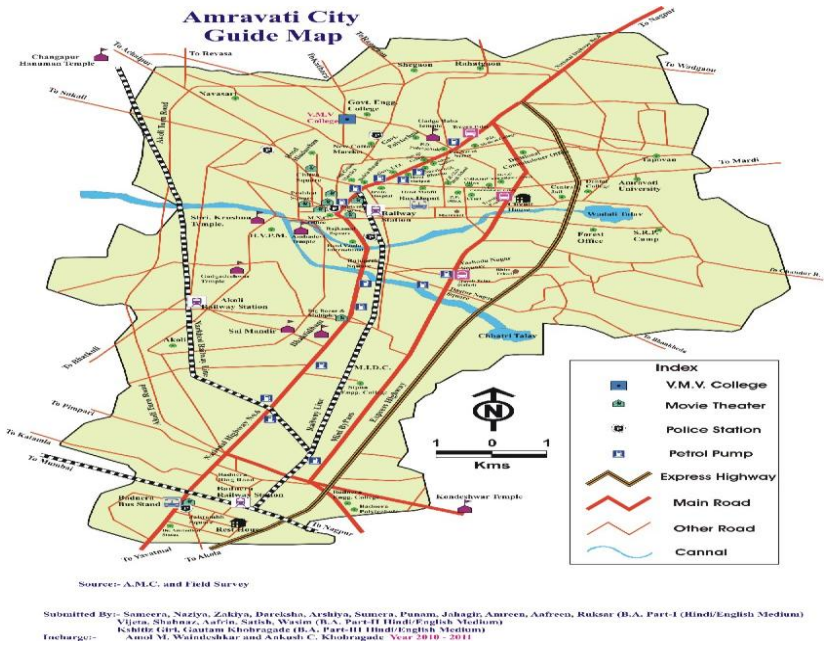
In India, most of the population is dependent on groundwater as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems[5]. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of groundwater quality.[6] Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application[7]. The lakes have complex and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants[8]. Today contamination of water by toxic heavy metals resulting from the discharge of industrial wastewater is a worldwide environmental problem. Many industries, particularly in metal processing operations and refineries, represent significant sources of heavy metal emissions. Unlike organic compounds, soluble heavy metals, such as copper, cadmium, lead, and chromium, are non-biodegradable and toxic even at trace levels. Heavy metals can accumulate in living organism and cause various diseases[9-13].

The most of water bodies in India needs to be treated before using it in domestic applications by various means. Ground water contains high amount of various ions, salts etc. so if we were using such type of water as potable water then it leads to various water-borne diseases[14]. The consequence of urbanization and industrialization eads to spoil the water. For agricultural purposes ground water is explored in rural areas especially in those areas where other sources of water like dam and river or the canal is not available. During last decade, this is observed that the ground water get polluted drastically because of increased human activities[15-18].

Hence it is very essential to maintain the quality of surface and ground water for human consumption, for the aquatic life and for other subsequent uses. Considering the above aspects of surface water contamination, the present study was undertaken to investigate the microdetermination of Trace metals contamination of water samples from various water samples were collected and was assess. The sampling points were selected on the basis of their importance. The heavy metals like Al, As, Co, Pb, Cu, Ni and Zn were analyzed in water samples of various chemical laborites, industries and two tanks in Amravati area. The analyzed data were compared with standard values recommended by WHO[19].

2. METHODS AND MATERIALS

Amravati city (Distract Amravati, MS) which is situated in the heart of the nation in Maharashtra (Vidarbha region) has become an important city because of the natural resources available around it. There are various existing industries and industrial estates.



These industries use huge quantity of water for processing and release most of the water in the form of wastewater. The wastewater being generated is discharged into the nearby water resources. Similarly the geochemical and morphological structural changes due to weathering may also leache out some chemicals/minerals from the geostrata into surface and groundwater and may change the original characteristics of water which could be rather harmful to human health after consumption. The literature survey reveals that no water quality management studies are made in this region so far. Hence the present study was planned and undertaken. Table No. -1 represented the site selected were from different localities in Amravati city for samples collection.

2.1. Locations and Sample Collection

In the present investigation, wells including dug wells and borehole wells were selected for water analysis. The studied area covers a distance of approximately 15 kilometers, which includes sites along Ambanala, MIDC area, and VMV area in Amravati city. 17 different sites were selected for simplicity and convenience. These were named and grouped as under-

Table1. *Different localities in Amravati city for samples collection.*

S.N.	Group I	Group II	Group III
	Near Amba Nala Area	**Near MIDC Area**	**From VMV Area**
1	AN - I	MIDC - I	VMV - I
2	AN – II	MIDC – II	VMV – II
3	AN – III	MIDC – IIII	VMV – IIII
4	AN – IV	MIDC – IV	VMV – IV
5	AN - V	MIDC - V	VMV – V
6	-	-	VMV – VI
7	-	-	VMV – VII

2.2. Sampling and Sample Preservation

Significance of a chemical analysis depends on to a large extent, on the sampling. It includes selection of sampling sites, sampling frequency, method of sample collection and preservation of sample. All the precautionary measures were taken into consideration as serious errors may be introduced during sampling and storage because of contamination from sampling device, failure to remove residues of previous samples from sample container and loss of metals by absorption on and/or precipitation in sample container caused by failure to acidify the sample properly. Samples were collected to obtain representative sample of each site. Grab (manually collected sample at a point where flow is homogeneous) sampling method is applied. Before collecting a sample, dug well was pumped for a long time, so that the sample represents the groundwater that feeds the well. The sampling was done in the morning between 8.00 am to 12.00 noon in thoroughly cleaned 5.0 liter, plastic containers which were rinsed with same water sample before collection. These containers were previously soaked in 2 % HNO_3 solution for 24 Hrs, followed by multiple rinsing with deionised water. The stoppers of the sample containers were closed properly to prevent outside contamination after adding concentrated HNO_3 (1.5 ml/l). The containers were labeled describing the name of the water sample, date, time, sampling point and condition under which it was sampled. All the sample containers were brought to the laboratory as early as possible and stored in refrigerator for further treatment and analysis at 4^oC to prevent changes in volume due to evaporation.

2.3. Preliminary Treatment of Sample

Samples containing particulates or organic material generally require pretreatment before spectroscopic analysis. “Total metals” includes all metals, inorganically and organically bound, both dissolved and particulate. Colorless, transparent samples (primarily drinking water) having a turbidity of <1 NTU, no odour, and single phase were analyzed directly by atomic absorption spectroscopy for total metals without digestion. For further verification or if changes in existing matrices were encountered, then compared with digested and undigested samples to ensure comparable results. All other samples were digested before determining total metals by AAS. To analyze for dissolved metals, samples were filtered, acidified, and stored until analyses could be performed.

Care was taken not to introduce metals into samples during preliminary treatment. During pretreatment contact with rubber, metal-based paints, cigarette smoke, paper tissues, and all metal products including those made of stainless steel, galvanized metal, and brass was avoided. Vessels were kept covered with watch glasses and turned spouts away from incoming air to reduce airborne contamination. Plastic pipette tips often are contaminated with copper, iron, zinc, and cadmium; so before use always soaked in 2N HCl or HNO_3 for several days and rinsed with deionized water. Using coloured plastics, which could contain metals and while analyzing for Aluminum use of glass, was avoided.

Metal-free water for all operations was used. Reagent-Grade acids were used for preservation, extraction, and digestion for purity. Through all digestion and filtration steps process blanks adopted and evaluation of blank results relative to corresponding sample results was carried out.

2.3.1. Trace Elements analysis

A total of 17 water samples were collected from in Amravati city. The samples were listed in Table-1. Special care was taken to avoid contamination during sampling for dissolved trace element. The trace elements analysis was done according to standard methods[22-23]. For trace elements determination Atomic Absorption Spectrophotometer and NAA technique were used [24]. The Trace elements like Al, As, Co, Pb, Cu, Ni and Zn were analyzed.

The trace elements of the above mention sites in Amravati city in water samples was calculated and described as below Water samples (50 ml) were digested with 10 ml of concentrated HNO_3 at 80 ºC until the solution became transparent. These transparent solutions were then filtered through Whatman filter paper number 42 and diluted to 50 ml with distilled water. The concentrations of Al, As, Co, Pb, Cu, Ni and Zn in the filtrate were determined by using atomic absorption spectrophotometer (Model 2380, Perkin Elmer, Inc. Norwalk, CT, USA), fitted with a specific lamp of particular metal using appropriate drift blanks and the concentrations of As in the filtrate were determined by using Neutron Activation Analysis methods. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions. Recently in our laboratory Heavy metals in the environment has increased beyond acceptable levels due to human intervention through

developmental activities including industries and agriculture. These heavy metals become toxic and they accumulate in soft tissues of animals when they enter body through food, water, air or the skin [25-28].

3. RESULTS AND DISCUSSION

The trace elements analysis of the above mention sites in Amravati city for water samples can be calculated and it is describe as bellow.

3.1. Aluminium (Al)

In the Earth's crust, aluminium is the most abundant (8.3% by mass) metallic element and the third most abundant of all elements (after oxygen and silicon). The Earth's crust has a higher prevalence of aluminium than the rest of the planet, due to aluminium silicates in the crust. In the Earths mantle, which is only 2% aluminium by mass, these aluminium silicate minerals are largely replaced by silica and magnesium oxides The Al content in the study area was found in S_6 in large amount and S_3 in low amount sites. It is May due to industrial area around these sites.

3.2. Cobalt (Co)

Free cobalt (the native metal) is not found in on Earth due to the amount of oxygen in the atmosphere and chlorine in the ocean. Oxygen and chlorine are abundant enough in the upper layers of the Earth's crust so as to make native metal cobalt formation extremely rare. Except as recently delivered in meteoric iron, pure cobalt in native metal form is unknown on Earth. Though the element is of medium abundance, natural compounds of cobalt are numerous. Small amounts of cobalt compounds are found in most rocks, soil, plants, and animals. The Co content in the study area was found in S_{12}, $S_{13,}$ sites

3.3. Lead (Pb)

Lead has long been recognized as a harmful environmental pollutant. It is also called lead is one of the environmental threat that affect health of children. There are many ways in which humans are exposed to lead through air, drinking water, food, contaminated soil. No Pb content in the study area was found from S_1 to S_{17} sites.

3.4. Cupper (Cu)

Copper is a widely used metal employed in many fields like transportation, manufacturing, currency, transportation of electricity, construction and agriculture field. Sources of copper in water are extensive, in addition to natural levels originating from rocks weathering and atmospheric deposition. The Cu content in the study area was found in S_{10} and S_{14} sites.

3.5. Nickel (Ni)

Nickel is a nutritionally essential trace metal for at least several animal species, micro-organisms and plants, and therefore either deficiency or toxicity symptoms can occur when, respectively, too little or too much Ni is taken up. Although a number of cellular effects of nickel have been documented, a deficiency state in humans has not been described. The Ni content in the study area was found in S_8, $S_{9,}$ and S_{12} sites. All other sites have no Ni contents.

3.6. Zinc (Zn)

Zinc occurs naturally in many foods and so is present in all human wastes which are flushed down the toilets. This is the largest single contribution of zinc from domestic activities. The Zn content in the study area was found in S_9 and S_{10} sites.

3.7. Arsenic (As)

Arsenic makes up about 1.5 ppm (0.00015%) of the Earth's crust, making it the 53rd most abundant element. Soil contains 1–10 ppm of arsenic. Seawater has only 1.6 ppb arsenic. Minerals with the formula MAsS and MAs_2 (M = Fe, Ni, Co) are the dominant commercial sources of arsenic, together with realgar (an arsenic sulfide mineral) and native arsenic. An illustrative mineral is arsenopyrite (FeAsS), which is structurally related to iron pyrite. Many minor As-containing minerals are known. Arsenic also occurs in various organic forms in the environment. The As content in the study area was found in S_1 and S_6 sites. All the data can be summarized in *Table-2*.

Table2. *Trace metal ions concentration at different sites*

S. No.	Sampling points	Sample number	Trace elements in And Around Amravati City (Surface water) mg/L						
			Al	Cu	Pb	Zn	Ni	As	Co
1.	AN - I	S_1	0.012	-	-	-	0.019	0.0112	0.034
2.	AN – II	S_2	0.013	-	-	0.025	-	-	0.018
3.	AN – III	S_3	0.011	0.07	-	0.90	-	-	-
4.	AN – IV	S_4	0.012	-	-	0.08	-	-	-
5.	AN - V	S_5	0.012	-	-	0.01	-	-	0.019
6.	MIDC - I	S_6	0.3	0.07	-	0.08	0.009	0.07	0.09
7.	MIDC – II	S_7	0.07	0.04	-	0.014	-	-	0.05
8.	MIDC – IIII	S_8	0.3	0.2	-	0.07	0.8	-	0.04
9.	MIDC – IV	S_9	0.03	0.3	-	5.00	0.1	-	0.03
10.	MIDC - V	S_{10}	0.02	0.9	-	7.00	0.047	-	-
11.	VMV - I	S_{11}	-	-	-	-	-	-	-
12.	VMV – II	S_{12}	-	-	-	-	0.05	-	0.4
13.	VMV – IIII	S_{13}	-	0.6	-	-	0.02	-	0.8
14.	VMV – IV	S_{14}	0.04	0.7	-	0.05	-	-	-
15.	VMV – V	S_{15}	0.02	-	-	2.00	-	-	-
16.	VMV – VI	S_{16}	0.2	-	-	-	-	-	-
17.	VMV – VII	S_{17}	0.07	-	-	-	-	-	-
18.	WHO	-	0.2	0.05	0.05	5.0	0.07	-	-

4. CONCLUSION

Deviations were observed by some water samples in and Around Amravati city. The water samples from sites S_{13} and S_6 showed poor water quality as compared to other water samples, probably due to MIDC close to site S_6. The water samples from sites S_{13} and S_6 are polluted and unfit for drinking purpose. The sampling point S_9, S_{10} showed high Zn content indicating the need of some treatment for minimization of the parameters. The sampling sites S_{16} and S_{17} and S_{11} showed no trace elements content, the quality of water is good and it is fit for drinking purpose.

ACKNOWLEDGEMENTS

The authors are very thankful to the UGC, New Delhi, for financial support.

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AUTHORS' BIOGRAPHY

Dr. A. R. Raut, Government Vidarbha Institute of Science And Humanities, Amravati, 444604 (M.S.), India

S. M. Bombatkar, Department of chemistry, Dr. R. G. Rathod Arts and Science College, Murtizapur, India

G. H. Murhekar, Government Vidarbha Institute of Science And Humanities, Amravati, 444604 (M.S.), India