



# Trace Metals Contamination of Surface Water Samples in and Around Akot City in Maharashtra, India

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Available online at: [www.isca.in](http://www.isca.in)

Received 24<sup>th</sup> February 2012, revised 1<sup>st</sup> March 2012, accepted 28<sup>th</sup> April 2012

## Abstract

*The Trace metals contamination of water samples from various samples surface water in and around Akot city was assess. The sampling points were selected on the basis of their importance. The heavy metals like Cd, Cr, Pb, Cu, Ni and Zn were analyzed in surface water samples of rivers lake and field water pond. The results were compared with standards prescribed by WHO and ISI. It was found that the surface 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:** Surface water, trace metals, Akot city, in and around, assessment.

## 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 essential requirement of all life supporting activities<sup>1</sup> 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<sup>2-4</sup>.

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<sup>5</sup>. 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.<sup>6</sup> Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application<sup>7</sup>. The lakes have complex and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants<sup>8</sup>. 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<sup>9-13</sup>.

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<sup>14</sup>. 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<sup>15-18</sup>.

Hence it is very essential to maintain the quality of surface 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 impact of the surface water quality of river, lake and field water pond water samples in and around Akot city of Akola district in Vidarbha region. Thus, in this research work an attempt has been made to assess the trace metals like, Cd, Cr, Pb, Cu, Ni and Zn were analyzed. The analyzed data were compared with standard values recommended by WHO<sup>19</sup>

## Material and Methods

Akot city (Distract Akola) 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 1 represented the site selected were from different localities in and around Akot city for samples collection.

**Preparation of water samples:** The sample were collected from all the stations at 9.00 am to 12.00 noon for trace elements examinations, different methods of collection and handling were adopted based the standard procedures<sup>20-21</sup>. The samples were collected in a 5000 ml pre acid - washed polypropylene bottle and 1 ml of concentrated HNO<sub>3</sub> was added to the sample to avoid microbial activity. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator maintained at 4°C. Water samples from eighteen sampling sites were collected during a post monsoon period of five months i.e. November-2009 to March -2010 (table-1).

**Trace Elements analysis:** A total of 14 surface water samples were collected from in and around Akot city. Water samples from fourteen sampling sites were collected during a post monsoon period of five months ie November-2009 to March -2010. The wells sampled 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<sup>22-23</sup>. For trace elements determination atomic absorption spectrophotometer were used. The Trace elements like Cd, Cr, Pb, Cu, Ni and Zn were analyzed.

The trace elements of the above mention sites in and around Akot city in ground water was calculated and described as below water samples (50 ml) were digested with 10 ml of concentrated HNO<sub>3</sub> at 80°C 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 Cd, Cu, Pb, Zn, Ni and Cr 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. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions.

## Results and Discussion

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

**Cadmium (Cd):** Cadmium can mainly be found in the earth's crust. After being it enters the environment mainly through the ground. It is found in manures and pesticides. Cadmium waste streams from the industries mainly end up in soils. Cadmium waste streams may also enter the air through waste combustion and burning of fossil fuels. The Cd content in the study area was found in S<sub>1</sub> and S<sub>6</sub> sites. It is May due to used of pesticides in large extent. All other sites have no Cd contents.

**Chromium (Cr):** People can be exposed to chromium through breathing, eating or drinking and through skin contact with chromium or chromium compounds. The main route of chromium uptake, as chromium (III) occurs naturally in many vegetables, fruits, meats, yeasts and grains. Various ways of food preparation and storage may alter the chromium contents of food. When food is stored in steel tanks or cans, chromium concentrations may rise. The Cr content in the study area was found in S<sub>1</sub>, S<sub>2</sub>, S<sub>5</sub>, S<sub>6</sub>, S<sub>7</sub>, S<sub>8</sub> and S<sub>9</sub> sites. All other sites has no Cr contents.

**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<sub>1</sub> to S<sub>14</sub> sites.

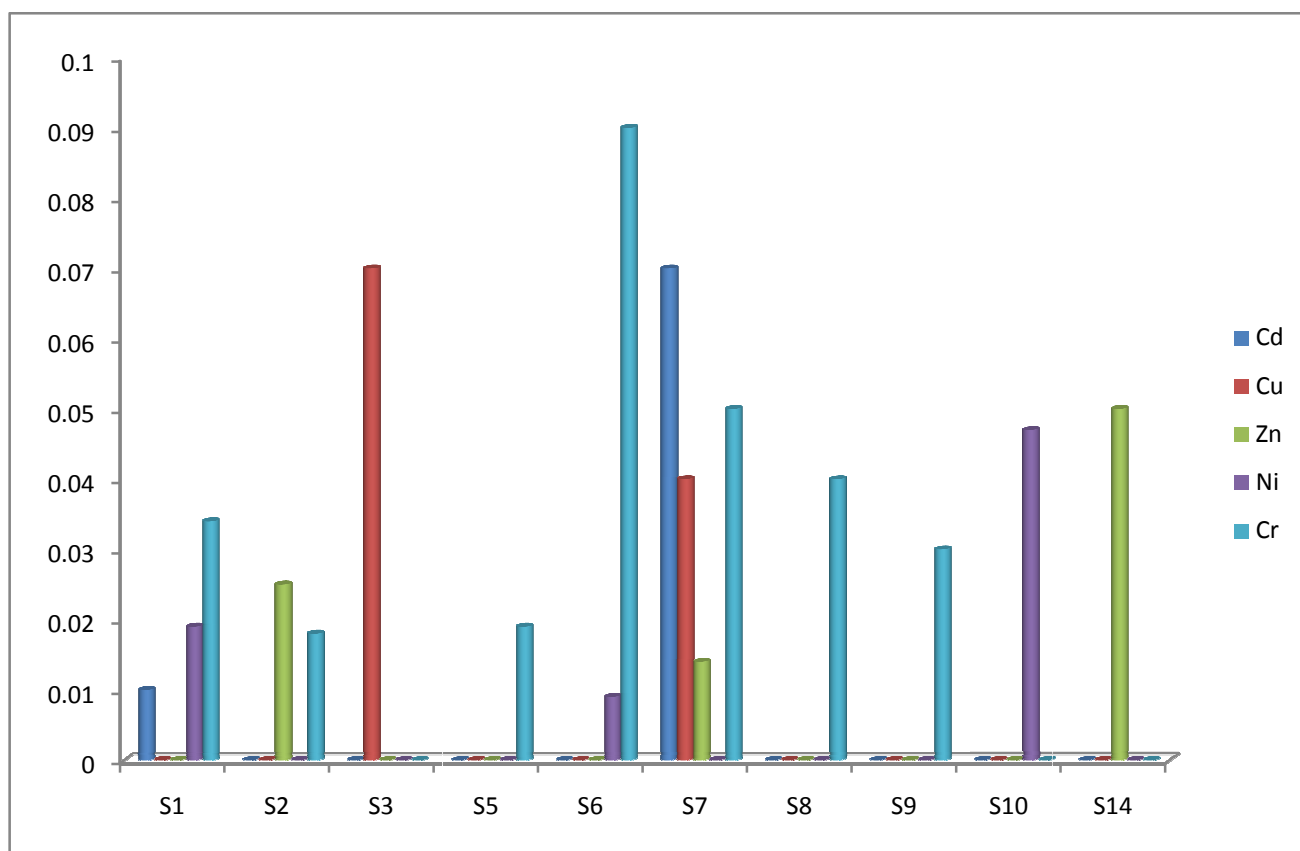
**Copper (Cu):** Copper is a widely used metal employed in many fields like transportation, manufacturing, currency, transportation of electricity, construction and agriculture field. Sources of copper in water are extensive, in addition to natural levels originating from rocks weathering and atmospheric deposition. The Cu content in the study area was found in S<sub>3</sub> and S<sub>6</sub> sites. All other sites has no Cu contents.

**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<sub>1</sub>, S<sub>6</sub>, and S<sub>10</sub> sites. All other sites have no Ni contents.

**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<sub>2</sub>, S<sub>14</sub> and S<sub>7</sub> sites. All other sites have no Zn contents. All the data can be summarized in table-2. And graphical representation of average values of the physicochemical parameters of different sites in Akot city as shown in figure-1.

**Table -1**  
**Sampling locations in Akot city**

| S. No. | Sample locations       | Source           | Sample number   | Distance from Akot city | Side from Akot City |
|--------|------------------------|------------------|-----------------|-------------------------|---------------------|
| 1      | Shiv Mandir,           | River            | S <sub>1</sub>  | 00 km                   | In Akot             |
| 2      | Near Gangane School,   | River            | S <sub>2</sub>  | 00 km                   | In Akot             |
| 3      | Sonwaewesh,            | River            | S <sub>3</sub>  | 00 km                   | In Akot             |
| 4      | Bhim Nagar,            | River            | S <sub>4</sub>  | 00 km                   | In Akot             |
| 5      | Shivaji Nagar          | Canal            | S <sub>5</sub>  | 00 km                   | In Akot             |
| 6      | Lohari Road Near MIDC, | River            | S <sub>6</sub>  | 00 km                   | In Akot             |
| 7      | Chandikapur            | River            | S <sub>7</sub>  | 09 km                   | East side           |
| 8      | Panaj                  | River            | S <sub>8</sub>  | 10 km                   | East side           |
| 9      | Lolari                 | River            | S <sub>9</sub>  | 06 km                   | West side           |
| 10     | Jalgaon Nahate         | River            | S <sub>10</sub> | 07 km                   | West side           |
| 11     | Popatkhad,             | Lake             | S <sub>11</sub> | 09 km                   | North side          |
| 12     | Belkhed                | Lake             | S <sub>12</sub> | 11 km                   | North side          |
| 13     | Kalwadi                | Field water pond | S <sub>13</sub> | 06 km                   | South side          |
| 14     | Kutasa                 | Field water pond | S <sub>14</sub> | 07 km                   | South side          |



**Figure-1**  
 Graphical representation of average values of the trace elements of different sites in Akot city

**Table -2**  
**Average results of the Trace elements of different sites in and around Akot city for surface water**

| S. No. | Sampling points       | Sample number   | Trace elements in And Around Akot City (Surface water) mg/L |      |    |       |       |       |
|--------|-----------------------|-----------------|---|------|----|-------|-------|-------|
|        |                       |                 | Cd  | Cu   | Pb | Zn    | Ni    | Cr    |
| 1      | Shiv Mandir,          | S <sub>1</sub>  | 0.01  | -    | -  | -     | 0.019 | 0.034 |
| 2      | Near Gangane School,  | S <sub>2</sub>  | -   | -    | -  | 0.025 | -     | 0.018 |
| 3      | Sonwaewesh,           | S <sub>3</sub>  | -   | 0.07 | -  | -     | -     | -     |
| 4      | Bhim Nagar,           | S <sub>4</sub>  | -   | -    | -  | -     | -     | -     |
| 5      | Shivaji Nagar         | S <sub>5</sub>  | -   | -    | -  | -     | -     | 0.019 |
| 6      | Lohari Road Near MIDC | S <sub>6</sub>  | --  | -    | -  | -     | 0.009 | 0.09  |
| 7      | Chandikapur           | S <sub>7</sub>  | 0.07  | 0.04 | -  | 0.014 | -     | 0.05  |
| 8      | Panaj                 | S <sub>8</sub>  | -   | -    | -  | -     | -     | 0.04  |
| 9      | Lolari                | S <sub>9</sub>  | -   | -    | -  | -     | -     | 0.03  |
| 10     | Jalgaon Nahate        | S <sub>10</sub> | -   | -    | -  | -     | 0.047 | -     |
| 11     | Popatkhad,            | S <sub>11</sub> | -   | -    | -  | -     | -     | -     |
| 12     | Belkhed               | S <sub>12</sub> | -   | -    | -  | -     | -     | -     |
| 13     | Kalwadi               | S <sub>13</sub> | -   | -    | -  | -     | -     | -     |
| 14     | Kutasa                | S <sub>14</sub> | -   | -    | -  | 0.05  | -     | -     |

### Conclusion

Deviations were observed by some surface water samples in and Around Akot city. The water samples from sites S<sub>6</sub> and S<sub>1</sub> showed poor water quality as compared to other water samples, probably due to MIDC close to site S<sub>1</sub>. The water samples from sites S<sub>6</sub> and S<sub>1</sub> are polluted and unfit for drinking purpose. The sampling point S<sub>2</sub>, S<sub>7</sub> and S<sub>14</sub> showed high Zn content indicating the need of some treatment for minimization of the parameters. The sampling sites S<sub>11</sub> and S<sub>12</sub> and S<sub>13</sub> 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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