*Current World Environment* Vol. **8**(1), 103-106 (2013)

# Drinking water assessment of 4 locations from Ghaziabad, Uttar Pradesh

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DOI : http://dx.doi.org/10.12944/CWE.8.1.11

(Received: December 20, 2012; Accepted: January 19, 2013)

**ABSTRACT**

In this study drinking water samples from 4 different locations in Ghaziabad were collected by random grab sampling. These were analyzed for physiochemical and elemental parameters. The parameters tested were pH, Nitrate, Fluoride, Chloride,Sulphate, Total Dissolved solids, Hardness, Alkalinity, Calcium, Magnesium, Aluminium, Boron, Zinc, Selenium, Manganese, Iron, Chromium, Copper, Lead, Cadmium, Arsenic and Mercury.

**Key words**: Physiochemical, elemental analysis, drinking water, Ghaziabad,Lohia Nagar, Sec-16, Jatwara, Sahibabad.

## INTRODUCTION

The district of Ghaziabad is situated in the middle of Ganga-Yamuna doab. It lies on the Grand Trunk road about a mile east of the Hindon river in Latitude 280 40' North and Longitude 770 25' East, 19 Kms. east of Delhi[1].Since a few years, drinking water problem has increased in the area. In this study, drinking water samples have been collected from 4random locations from the area. Different parameters were examined using Indian Standards[2] to find out their suitability for drinking purposes. During this examination, mainly the physico chemical parameters and the elemental concentrations were taken into consideration.

## MATERIAL AND METHODS

Standard methods of collection, preservation and analysis were adopted. Grab sampling method was used for the collection of 4drinking water samples. The locations were selected randomly in the district of Ghaziabad. The analysis of physiochemical parameters was done by procedure adopted from standard methods: APHA[3] and the elemental analysis weredone using ICPMS (Inductively Coupled Plasma Mass Spectrometer, PERKIN ELMER, ElanDRCe).

## RESULTS AND DISCUSSION

**Sample 1,Lohia Nagar**

All physiochemical parameters were found to be under the maximum permissible range for drinking purposes. This is with the exception of fluoride which was observed to be 3.723 ppm in the water sample analyzed.

Fluoride is released into the ground water through weathering of primary silicates and associated accessory minerals[4]. Mineral fluorides are present in underground water structures in the form of leachates from fluorospar, Apatite, Cryolite and fluorosilicates[5-6]. When rain water percolates through the ground, fluoride ions are picked up 9. In arid regions with limited water recharge and with fluoride bearing minerals deposits present, the ground water becomes rich in fluoride[5]. It combines with the hydrochloric acid of stomach and leads to the formation of hydrogen fluoride which is highly

corrosive[7]) Very low doses of fluoride (<0.6 mg/L) in water promote tooth decay. However, when consumed in higher doses (>1.5 mg/L), it leads to dental fluorosis or mottled enamel and excessively high concentration (>3.0 mg/L) of fluoride may lead to skeletal fluorosis[8].

**Sample 2,Sec-16**

All physiochemical parameters were found to be under the maximum permissible range for drinking purposes. Except fluoride, the value for which was found to be 1.66 ppm.

**Sample 3, Jatwara**

All physiochemical parameters were found to be under the maximum permissible range for drinking purposes exceptnitrate and fluoride. The values for these were found to be 187.583 and 3.472 ppm respectively for the water sample analyzed. Such high concentration of nitrate in drinking water may be attributed to the leaching of organic material biodegradation products into water sources. Nitrate has long been associated with the occurrence of blue baby disease in infants[9] or infantile methaemoglobinaemia, which is caused due to bacterial reduction of nitrate into nitrite in stomach[10].

**Sample 4, Sahibabad**

The values for except Aluminium, Iron and

**Table 1: List of methods and instruments used for physiochemical and elemental analysis**

| S. No. | Parameter | Method/ Instrument used |
|---|---|---|
| 1 | pH | pH meter |
| 2 | Total Dissolved Solids | Total Dissolved Solids dried at $100^0$C |
| 3 | Chloride | Argentometric method |
| 4 | Hardness | EDTA titrimetric method |
| 5 | Fluoride | SPADNS method |
| 6 | Sulphate | Turbidity method |
| 7 | Nitrate | Ultraviolet Spectrophotometric Screening Method |
| 8 | Alkalinity | Titration method |
| 9 | Calcium | Detection by AAS |
| 10 | Magnesium | Detection by AAS |
| 11 | Elemental Analysis (Al, B, Zn, Se, Ca, Mn, Fe, Mg, Cr, Cu, Pb, Cd, As, Hg) | Detection by ICPMS, Prekin Elmer, ElanDRCe |

**Table 2:Values for Physiochemical Parameters obtained by chemical methods**

| S. No. | Parameter | Unit of measurement | IS 10500 value | Lohia Nagar | Sec-16 | Jatwara | Sahibabad |
|---|---|---|---|---|---|---|---|
| 1 | pH | - | 7.5-8.5 | 7.19 | 8.03 | 7.24 | 7.91 |
| 2 | Sulphate | mg/L | 400 | 20.5 | 19 | 76 | 38 |
| 3 | TDS | % | 0.2 | 0.06 | 0.018 | 0.113 | 0.0592 |
| 4 | Nitrate | mg/L | 100 | 99.79 | 5.658 | 187.583 | 5.365 |
| 5 | Chloride | mg/L | 1000 | 51.984 | 11.996 | 363.887 | 2.931 |
| 6 | Hardness | mg/L | 600 | 161.28 | 88.32 | 291.84 | 49.92 |
| 7 | Fluoride | mg/L | 1 | 3.723 | 1.66 | 3.472 | 4.68 |
| 8 | Alkalinity | mg/L | 600 | 51.22 | 11.82 | 35.46 | 23.64 |

**Table 3: Values of elemental analysis obtained by Atomic Absorption spectrophotometer (AAS) and Inductively Coupled Plasma Mass Spectrometer (ICPMS)**

| S. No. | Parameter | Symbol | Unit of measure-ment | IS 10500 max. value | Lohia Nagar | Sec-16 | Jatwara | Sahibabad |
|---|---|---|---|---|---|---|---|---|
| 1 | Aluminium | Al | ppb | 200 | 0.017 | 196.13 | 0.01 | 228.88 |
| 2 | Boron | B | ppb | 5000 | 0.256 | 0.052 | 0.371 | 0.456 |
| 3 | Zinc | Zn | ppb | 15000 | 0.318 | 0.029 | 0.013 | 0.238 |
| 4 | Selenium | Se | ppb | 10 | 1.446 | 0.111 | 0.0336 | 0.118 |
| 5 | Calcium | Ca | ppm | 200 | 17.258 | 10.887 | 26.482 | 8.886 |
| 6 | Manganese | Mn | ppb | 300 | 62.54 | 3.36 | 4.798 | 19.019 |
| 7 | Iron | Fe | ppb | 1000 | 626.94 | 186.53 | 387.16 | 4598.76 |
| 8 | Magnesium | Mg | ppm | 100 | 34.997 | 18.816 | 64.482 | 9.971 |
| 9 | Chromium | Cr | ppb | 50 | 1.143 | 0.299 | 0.835 | 0.547 |
| 10 | Copper | Cu | ppb | 1500 | 1.302 | 0.0476 | 1.258 | 2.037 |
| 11 | Lead | Pb | ppb | 50 | 0.063 | 0.004 | 0.036 | 0.435 |
| 12 | Cadmium | Cd | ppb | 10 | 0.081 | 0.019 | 0.044 | 0.128 |
| 13 | Arsenic | As | ppb | 50 | 3.588 | 7.451 | 2.94 | 3.142 |
| 14 | Mercury | Hg | ppb | 1 | ND | 0.031 | ND | ND |

fluoride were found to be high in the sample analyzed. The value for Aluminium was observed to be 228.88 ppb which is higher than the IS prescribed limit of 200 ppb. The valuesfor Iron was recorded to be 4598.76 ppb and for fluoride as 4.68 ppm.All other physiochemical parameters were found to be under the maximum permissible range for drinking purposes.

Long-term exposure to such high levels of Aluminum may lead to the occurrence of Alzheimer's disease[11]. Aluminium accumulation in the brain is proposed to be associated with neurodegenerative diseases, including Parkinson's disease, amyotrophic lateral sclerosis and dialysis encephalopathy[12]. Aluminium negatively impacts neurotransmission, either by directly inhibiting the enzymes responsible or by affecting the physical properties of synaptic membranes[13].

The principal forms of mineralized ferric iron found in soils are amorphous hydrous ferric oxide, maghemite, lepidocrocite, hematite,and goethite[13]. High amount of Iron leads to the growth of iron bacteria in the pipelines thereby deteriorating the microbiological quality of drinking water[14]. Excessive ingested iron can also cause excessive levels of iron in the blood because high iron levels can damage the cells of the gastrointestinal tract preventing them from regulating iron absorption[15].

## CONCLUSION

Drinking water from Lohia Nagar & Sector 16 couldbe used for drinking after removal of excess of fluoride.

Also drinking water from Jatwara could be used for drinking after removal of excess of fluoride and nitrate.

Drinking water from Sahibabad could also be used for drinking after removal of excess of fluoride, Aluminium and Iron.

## ACKNOWLEDGEMENTS

The authors are thankful to Arbro Analytical Division, New Delhi for providing research facilities.

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