*International Journal of Farm Sciences* **5(1)** : 163-167, 2015

# Assessment of groundwater quality at different sites of Bara Tehsil, Allahabad, UP

**SATYENDRA NATH, MOHD NAFEES and AFAQ MAJID WANI***

**Department of Environmental Science**
***Department of Forestry**
**School of Forestry and Environment**
**Sam Higginbottom Institute of Agriculture Technology and Sciences**
**(Formerly Allahabad Agriculture Institute) Deemed University**
**Allahabad 211007 UP, India**
Email for correspondence: aaidusn@gmail.com

## ABSTRACT

Groundwater samples were collected from five locations of Bara Tehsil, Allahabad, UP. The samples were analyzed for the physico-chemical characteristics. Laboratory tests were performed for the analysis of samples for temperature, pH, electrical conductivity, total dissolved solids (TDS), turbidity, sulphate, total hardness, alkalinity, acidity and chloride. On comparing the results with drinking water quality standards laid by World Health Organization (WHO) it was found that at some places water samples exceeded the permissible limits. The temperature of all the sites varied from 25-29.2°C during January to April; pH value was within the limit; the range of EC was found between 0.72 to 2.2; the TDS level was well above the permissible limit; turbidity was in the range of 0.72-2.37 nephelometric turbidity unit (NTU); and the sulphte, total hardness, acidity, alkalinity and chloride content were 0.51 to 69.77, 240 to 662, 45-151, 272-522 and 30 to 323.64 mg/l respectively. The present study suggests that people exposed to groundwater source of study area Semera and Gauhania were prone to health hazards of polluted water and quality management was needed in these villages.

**Keywords:** Pollution; ground water; water quality

## INTRODUCTION

Freshwater is very important for healthy living. It plays key role in the life of every human being who survives in this world and is necessary by all living organisms for their survival. Inappropriate management and massive use of water are causing serious threats to the availability and quality of water. Groundwater may be considered as one of the most precious and one of the basic requirements for human existence and the survival of mankind providing him the luxuries and comforts in addition to fulfilling his basic necessities of life and also for industrial and agricultural development thus

being a very important constituent of our ecosystem (Sarala and Babu 2012). The groundwater is more cleaner and pollution free as compared to surface water. But during the last few decades it has been observed that groundwater is getting drastically polluted due to increase in population, rapid industrialization, unplanned urbanization and excess application of fertilizers and pesticides in agriculture (Joarder et al 2008). It is important for the existence of human society and is a liberal part of environment. Hence it cannot be looked in isolation especially where high degree of dependence is upon groundwater for drinking purpose (Singh 2006).

## MATERIAL and METHODS

The present region of Bara Tehsil (Allahabad district) is situated at latitudes of 25°282 N 81°502 E at the meeting point of the three sacred rivers the Saraswati, the Yamuna and the Ganges. In the ancient days the area was known as Vats country. There are 7 Tehsils and 20 blocks in the district.

Five sites one in each village viz Site 1 (Semera), Site 2 (Gauhania), Site 3 (Amreha), Site 4 (Jasara) and Site 5 (Khatangia) were selected from Bara Tehsil for assessing water quality. Water samples of hand pump were collected and analysed quantitatively for drinking purpose following standard methodology of sampling and estimation (Anon 1995) during January 2014 to April 2014.

The physico-chemical analysis of groundwater was done for various water quality parameters such as temperature, pH, electrical conductivity, total dissolved solids (TDS), turbidity, sulphate, total hardness, alkalinity, acidity and chloride as per standard procedures (Anon 1995).

## RESULTS and DISCUSSION

The results of the physico-chemical analysis of the groundwater samples are presented in the Table 1.

**Temperature:** Temperature is most important factor of biological significance that plays an important role in living organisms for metabolic activities. The atmospheric temperature influences water temperature also. The increase in temperature increases the amount of oxygen required by organisms. The temperature of all the sites varied from 25-29.2°C during January to April. The variation in the water temperature might be due to different timings of sample collection and influence of season.

**pH:** pH is the parameter for measuring acidity and alkalinity of water. The pH value of water is one of the indicators commonly used to find out the level of pollution. The WHO recommended value for water pH is 6.5-8.5. pH value of all the sites was within

the limit. The highest pH of 7.94 was recorded at Amreha village during the month of April.

**Electrical conductivity:** Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts (Dahiya and Kaur 1999). The range of EC was found between 0.72 to 2.2. The groundwater of Semera had highest EC of 2.2 in the month of March. Similarly the lowest EC of 0.72 was recorded at Amreha in March.

**Total dissolved solids (TDS):** The WHO recommended value for TDS as 500 mg/l. The TDS level of all sites was well above the permissible limit. The highest value of TDS 1337.75 mg/l was recorded in the month of February at Gauhania whereas the lowest value of 598.5 mg/l was recorded in the month of March at Semera.

**Turbidity:** Turbidity of ground water samples was found to be in the range of 0.72-2.37 nephelometric turbidity unit (NTU). According to WHO specification the desirable limit of turbidity in water is 5 NTU. Turbidity is due to the presence of excess amount of total solids. It was found within permissible limit at all sites.

**Sulphate:** The sulphate concentration was recorded between 0.51 to 69.77 mg/l. The highest concentration of sulphate was found 69.77 mg/l during the month of March at Semera and lowest concentration was found 0.51 mg/l in the month of January at Khatangia. The permissible limit of sulphate prescribed by WHO is 200 mg/l.

**Total hardness:** The value of total hardness was found between 240 to 662 mg/l. Almost all sites showed permissible limit of total hardness except Semera and Jasara. WHO has specified the total hardness to be within 500 mg/l of $CaCO_3$.

**Acidity:** The value of acidity was found in the range of 45-151 mg/l. The highest value for acidity was found in the groundwater of Semera in the month of February while the lowest value was recorded in the water of Gauhania in January.

**Alkalinity:** Total alkalinity value of groundwater samples ranged from 272-522 mg/l. The highest value of alkalinity was found at Semera in the month of April and the lowest value was found in Jasara during the month of February. The standard desirable limit of alkalinity in potable water is 120 mg/l. The maximum permissible level is 600 mg/l. The value of alkalinity of groundwater exceeded standard desirable limit at all sites compared to the prescribed value but were within the maximum permissible limit given by WHO.

**Chloride:** The permissible limit of chloride in drinking water is 250 mg/l. Chloride content of the groundwater samples ranged from 30 to 323.64 mg/l. All sites were within the permissible limit except Semera.

Table 1. Physico-chemical characteristics of groundwater quality of different villages in Bara Tehsil

| Sampling site | Sampling month | Parameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Temp (°C) | pH | EC (mmho/ (cm) | TDS (mg/l) | Turbidity (NTU) | Sulphate (mg/l) | Total hardness (mg/l) | Acidity (mg/l) | Alkalinity (mg/l) | Chloride (mg/l) |
| Semera | Jan | 25 | 7.21 | 1.74 | 1245.25 | 1.6 | 4.24 | 607.5 | 73.25 | 449 | 102.57 |
| | Feb | 29 | 7.05 | 1.01 | 1241 | 1.54 | 5.68 | 640 | 151 | 431.5 | 227.62 |
| | Mar | 29.1 | 7.16 | 2.2 | 1337.75 | 0.89 | 69.77 | 662 | 107.5 | 483.5 | 323.64 |
| | Apr | 29.2 | 7.26 | 1.51 | 1194 | 1.64 | 59.29 | 540 | 119.67 | 522 | 243.08 |
| | Mean | 28.08 | 7.17 | 1.61 | 1254.50 | 1.42 | 34.74 | 612.38 | 112.85 | 471.5 | 224.23 |
| Gauhania | Jan | 26.08 | 7.39 | 0.92 | 720.25 | 0.98 | 1.46 | 331.5 | 45 | 400 | 36.55 |
| | Feb | 28.5 | 7.43 | 0.88 | 598.5 | 1.43 | 0.95 | 240 | 90 | 284 | 39.47 |
| | Mar | 28.6 | 7.44 | 1.25 | 752.75 | 1.60 | 30.23 | 308 | 51.5 | 356 | 101.55 |
| | Apr | 28.5 | 7.60 | 1.22 | 775.33 | 2.17 | 37.93 | 318 | 74 | 411.67 | 105.20 |
| | Mean | 27.92 | 7.47 | 1.07 | 711.71 | 1.54 | 17.64 | 299.38 | 65.13 | 362.92 | 70.69 |
| Amreha | Jan | 26.5 | 7.69 | 1.15 | 862.75 | 1.49 | 1.36 | 219.5 | 48.5 | 511.75 | 30 |
| | Feb | 27.55 | 7.79 | 1.3 | 796 | 2.12 | 1.48 | 191 | 79.5 | 419 | 56.64 |
| | Mar | 28.88 | 7.78 | 0.72 | 898.75 | 1.89 | 22.42 | 260.5 | 50.75 | 456.25 | 85.27 |
| | Apr | 29 | 7.94 | 1.50 | 986 | 1.02 | 39.96 | 219.33 | 60 | 500.67 | 82.48 |
| | Mean | 27.87 | 7.80 | 1.17 | 885.5 | 1.63 | 16.31 | 222.58 | 59.69 | 471.92 | 63.60 |
| Jasara | Jan | 25.05 | 7.55 | 1.06 | 830 | 1.39 | 2.08 | 545 | 59.75 | 341 | 38.36 |
| | Feb | 27.55 | 7.55 | 1.17 | 775.5 | 2.81 | 1.53 | 570 | 72 | 272 | 74.69 |
| | Mar | 27.75 | 7.34 | 1.24 | 785.5 | 2.37 | 32.26 | 528 | 66 | 307 | 102.31 |
| | Apr | 28.57 | 7.43 | 1.30 | 765.67 | 1.73 | 41.49 | 540 | 82 | 317.33 | 88.80 |
| | Mean | 27.23 | 7.47 | 1.19 | 789.17 | 2.07 | 19.34 | 523.25 | 69.94 | 309.33 | 76.04 |
| Khatangia | Jan | 25.75 | 7.64 | 0.87 | 677 | 0.86 | 0.51 | 460.5 | 60.25 | 495.25 | 34.12 |
| | Feb | 27 | 7.19 | 1.07 | 709.5 | 0.72 | 0.53 | 497 | 104 | 350.5 | 70.18 |
| | Mar | 28.13 | 7.26 | 1.09 | 738.75 | 1.84 | 8.33 | 435.5 | 73.75 | 350.25 | 90.54 |
| | Apr | 28.5 | 7.6 | 1.2 | 750.7 | 1.4 | 14.0 | 414.7 | 89.33 | 370 | 99.8 |
| | Mean | 27.34 | 7.14 | 1.05 | 718.98 | 1.21 | 5.83 | 451.92 | 81.83 | 391.50 | 73.67 |

The present study suggests that people exposed to groundwater source of study area Semera and Gauhania were prone to health hazards of polluted water and quality management was needed in these villages.

## REFERENCES

Anonymous 1995. Standard methods for examination of water and waste water. 19th edn, American Public Health Association, American Water Works Association, Water Environment Federation, Washington DC.

Dahiya S and Kaur A 1999. Physico-chemical characteristics of underground water in rural areas of Tosham subdivision, Bhiwani district Haryana. Journal of Environmental Pollution **6(4):** 281 -288.

Joarder MA Raihan F, Alam JB Hasanuzzaman S 2008. Regression analysis of groundwater quality data of Sunamjang district Bangladesh. International Journal of Environmental Research **2(3):** 291-296.

Mishra A and Bhatt V 2008. Physico-chemical and microbiological analysis of underground water in VV Nagar and nearby places of Anand district, Gujarat, India. E-J Chemistry **5(3):** 487-492.

Murhekar GH 2011. Determination of physio-chemical parameters of surface water sample in and around Akot city. International Journal of Research in Chemistry and Environment **1(2):** 183-187.

Parashar C, Dixit S and Shrivastava R 2006. Seasonal variations in physico-chemical characteristics in Upper Lake of Bhopal. Asian Journal of Experimental Sciences **20(2):** 297-302.

Sarala C and Babu PR 2012. Assessment of groundwater quality parameters in and around Jawaharnagar, Hyderabad. International Journal of Scientific and Research and Publications **2(10):** 262-267.

Singh V 2006. Physico-chemical examination of water, sewage and industrial effluents. Research Journal of Chemistry and Environment **10(3):** 62-66.

***Received: 24.11.2014*** ***Accepted: 17.1.2015***