Acta Ciencia Indica, Vol. XLIII C, No. 3, 315 (2017)

ASSESSMENT OF DRINKING WATER QUALITY IN BUXAR AND ITS EFFECTS ON HUMAN HEALTH

ASHISH KUMAR

Deptt. of Chemistry, Patna Women's College, Patna, India

AND

BASABI MAHAPATRA

Deptt. of Chemistry, Magadh Mahila College, India

RECEIVED : 23 May, 2017

WATER is essential need for existence of life so, it should be pure. The physical parameters like conductivity, turbidity, total dissolved solid(TDS), total hardness and the chemical properties like pH, alkalinity, calcium, magnesium, fluoride, chloride, sulphate, iron, nitrate and arsenic was analysed by using different methods like titration and using different apparatus suggests us how safe water is for drinking. When these parameters were analysed in the areas of Buxar it was found that some of these were exceeding the permissible limit namely calcium (SADAR HOSPITAL) and arsenic (CIVIL LINE, NAYA BAZAR AND CHHOTA NUAWAN). The results showed that it is better to avoid the usage of drinking water directly from tube wells, taps, and direct source of water.

KEYWORDS : Conductivity, turbidity, total dissolved solid (TDS), total hardness, pH, alkalinity.

INTRODUCTION

Water is the principal need of life on earth, and is an essential component for all forms of lives, from micro-organism to man. The unplanned urbanization and industrialization (Singh *et al*., 2002) [1] has resulted in over use of environment (Petak, 1980) [2] in particular of water resource. A kind of crises situation has made getting clean water a serious problem. It is a known fact that when pure water is polluted its normal functioning and properties are affected.. The increased anthropogenic activities due to industrialization have contributed to decline in water quality. Several works have been reported on water quality of Buxar (Sinha *et al*., 20003a; Pandey and Pandey, 19803b and Tare *et al*., 20033c) and other parts of country (Pahwa, and Mehrotra, 1966) [4]. The authors studied water quality in different location choosen from Buxar. The maximum turbidity (1100-2170 ppm) was observed in monsoon and minimum (less than100 ppm) during January to June. The minimum value pH of the river water ranged between 7.3 (minimum) and 7.6 (maximum). A comprehensive study of physico-chemical properties of Ganga water at Buxar (Unnao) UP (Sinha,1986) [5], Narora and Kannauj, U.P. (Khan *et. al*,1984) [6], in and around Haridwar (Kaur and Joshi, 2003) [7] has also been reported. The seasonal analysis of Kanpur (Zafer and Sultana, 2007) [8] water showed that extent of pollution varied in different seasons. The steep growth in population due

to rapid urbanization and industrial development of Buxar city has increased the demand of water manifold. In the present work we report

Study area

Water samples were collected in sterile sample bottles from tap water. Total number of water samples collected were 10 from different areas of Buxar like civil line, sadar hospital, railway station, charitravan. Railway station, Pandey Patti, DAV public school, Naya Bazar, Chhota Nuawan, Ahirauli,Civil court. Survey regarding quality of water and diseases due to water contamination were also analyzed in different localities.

METHODS

The laboratory analysis of samples was done using standard methods (APHA, 1998) [9]. The water samples from different sites in plastic bottles and transported to the laboratory in an icebox jars to avoid unpredictable changes in different physico- chemical parameters from different regions of Buxar were collected *(Bureau of Indian Standards Publication IS: 3025*,) Part-44 and their physical and chemical parameters were analysed. The physical parameters analysed are as follows:

1. Conductivity
2. TDS (Total dissolved solids)
3. Total Hardness
4. Turbidity

Conductivity, and TDS were calculated by Microprocessor water analysis kit. The temperature probe was connected to the instrument and was dipped into the solution under test. The COND. was selected from main menu, the reading displayed the value of the desired sample. In the same way TDS was measured but by using a standard solution of KCl (0.01N) solution whose conductivity is 1.34 µs/cm and then the reading was taken for different samples. The displayed reading showed the value of desired sample.

Hardness was calculated by titration of water samples against 0.01 M EDTA solution and calculated by formula

Turbidity of water was measured by Turbiditimeter and the procedure is as follows:

1. The instrument was switched on and the range was selected with the help of standard solution.
2. The calibration control was set to minimum from clockwise position.
3. The tube containing distilled water was inserted into the cell holder and covered with the light shield cover.
4. SET ZERO was controlled to display the zero reading.
5. The tube was then removed and the standard solution of 100 NTU was inserted.
6. The caliberation control was set up to 100 NTU.
7. The standard solution was then replaced by solution under test.

CALCULATION OF VARIOUS PHYSICAL PARAMETERS

1. ELECTRICAL CONDUCTIVITY

= Observed conductance × cell constant × temperature factor

UNIT: μS/cm

2. TOTAL DISSOLVED SOLID = Observed TDS × TDS factor

UNIT: Parts per million (ppm)

3. HARDNESS $= \frac{A \times N \times 100 \times 1000}{V}$

where A = Litre value

N = Normality of EDTA

V = Volume of sample

4. TURBIDITY = The reading displayed the turbidity of the sample

UNIT: Nephlometric turbidity unit (NTU)

- Most important aspect of water quality assessment is the chemical characterisation of water (*APHA; 20th ed. (2008), Standard methods for the Examination of Water and waste water, American Public Health Association*).
- Chemical characteristics of water are expressed as composition of chemical substances and also the capability of appearance of the hydrolytic and non-hydrolytic reactions in water. (‘*Journal of Indian Water Works Association’*)

For chemical parameters which were analysed by titration method, three concurrent readings were taken and then calculated by their respective formulas. The various chemical parameters considered in our study and their methodologies are as follows:

1. pH
2. Calcium
3. Magnesium
4. Chloride
5. Alkalinty
6. Iron
7. Fluoride
8. Arsenic
9. Nitrate
10. Sulphate

pH :Analysis was done by pH-meter.

1. Observe the sample temperature and set the pH meter to the appropriate temperature.
2. Calibrate the pH meter against the standard buffer solution of pH 4.0, pH 7.0 and pH 9.2.
3. Now take the sample in a beaker and dip the electrode of pH meter into it and read pH. The electrode of pH meter must be cleaned after every reading.

Calcium: Analysis was done by titration method.

1. 10 ml of sample was taken in a conical flask and 2ml NaOH (0.1 N) solution was added to it and shaken.
2. A pinch of murexide indicator was added and the colour of the solution changes to pink.

After this, the solution was titrated against 0.01M EDTA. At the end point the pink colour changes to purple.

Calculation: Calcium (mg/l) as Ca = $\frac{A \times N \times 40.0 \times 1000}{V}$

where A = Litre value

N = Normality of EDTA

V = Volume of sample taken (25 ml)

Magnesium: Analysis done by EDTA method and calculated same as calcium on formula

$$\text{Mg (mg/l)} = \frac{A \times N \times 24.3 \times 1000}{V}$$

Chloride : Analysis done by titration method.

50 ml of water sample was taken in a conical flask and 1 ml of K_2CuO_4 (5%) indicator was to added it.

It was then titrated against $AgNO_3$(0.0141 N) to obtain the pinkish yellow colour at the end point.

Calculation: $\text{Cl} = \frac{A \times N \times 35.45 \times 1000}{V}$

Iron: It was tested by Iron testing kit by mercuric bromide method, it was done by following the instructions written inside the kit booklet.

CALCULATION: UNIT= micro gram per mL

Alkalinity: Was calculated by titration method and the procedure is as follows:

1. 10 mL of sample was taken in a conical flask added few drops phenolphthalein indicator to it.

2. If the solution remain colourless, phenolphthalein alkalinity is zero.

3. If the colour changed to pink, it was titrated against 0.1N HCl till the colour disappeared. This was phenolphthalein alkalinity.

4. Further titrated with methyl orange indicator till the end point was obtained. This was total alkalinity.

CALCULATION:

$$\text{Total Alkalinity as } CaCO_3\text{, mg/L} = \frac{(A \times \text{Normality) of HCl} \times 1000 \times 50}{\text{mL of sample}}$$

where, A=ml of total HCl used with phenolphthalein and methyl orange.

Fluoride

It was detected with the help of fluoride testing kit.the procedure is as follows:

1. 50ml of water sample was taken in a test tube and zirconyl aluzarine was added.

2. Gentle tilt the tube and allow develop colour.

CALCULATION:

UNIT: mg/L

Arsenic

It was tested by arsenic testing kit by mercuric bromide method,it was done by following the instructions written inside the kit booklet.

CALCULATION:

UNIT= micro gram per mL

Nitrate-

It was measured using UV- spectrophotometric method. The procedure is as follows:-

1. 50 ml of water sample was taken in a conical flask and 1 ml of conc. HCl was added to it.

2. Then the reading on UV- spectrophotometer was taken.

CALCULATION:

Nitrate as N (mg/l) = $(x - y) \times$ Slope of the Standard Curve for Nitrate

where x = absorbance at 220 nm

y = absorbance at 275 nm

Nitrate as NO_3^-(mg/l) = concentration of N ×4.43

Wavelenth : 220 nm and 275 nm

Sulphate

It was measured by Turbiditric method. The procedure is as follows:-

1. 50 ml of water sample was taken in a conical flask and 10ml of sulphate buffer solution was added to it.
2. A spoonful of $BaCl_2$ crystals was mixed in the above solution and the reading were taken on UV- spectrophotometer.

CALCULATION:

Sulphate = absorbance × Slope of the Standard Curve for Sulphate

Wavelenth: 420 nm

Results and discussion

Table 1. Physical Parameters

	COND. (µS/cm)	TDS	TH (mg/L)	TURBI (NTU)
CIVIL LINE	323	210	240	3.9
RAILWAY STATION	246	160	120	3.7
PANDEY PATTI	307	170–	200	3.3
DAV PUBLIC SCHOOL	276	162	180	3.1
SADAR HOSPITAL	301	196	200	3.6

CHARITRA VAN	515	335	140	3.8
NAYA BAZAR	350	228	160	2.7
CHHOTA NUAWAN	323	210	220	3.4
AHIRAULI	315	205	200	3.9
CIVIL COURT	292	170	240	3.2

Table 2. Chemical Parameters

	CAL. (mg/L)	**MAG. (mg/L)**	**ALKAL. (mg/L)**	**pH**
CIVIL LINE	80	38	200	7.4
RAILWAY STATION	48	17	120	7.5
PANDEY PATTI	72	30	120	7.5
DAV PUBLIC SCHOOL	56	29	120	7.3
SADAR HOSPITAL	80	288	160	7.3
CHARITRA VAN	64	18	260	7.4
NAYA BAZAR	48	26	180	7.6
CHHOTA NUAWAN	72	35	160	7.5
AHIRAULI	64	136	220	7.5
CIVIL COURT	64	42	260	7.6

Table 3. Chemical Parameter (Anions)

	SO_4^{-2}	**NO_3^{-2}**	**Cl^-**
CIVIL LINE	BDL	40	40
RAILWAY STATION	BDL	30	30
PANDEY PATTI	25	45	30
DAV PUBLIC SCHOOL	10	20	20
SADAR HOSPITAL	15	25	30
CHARITRA VAN	5	20	100
NAYA BAZAR	20	35	50
CHHOTA NUAWAN	15	30	60
AHIRAULI	5	20	40
CIVIL COURT	5	20	30

BDL stands for below detection limit

Table 4. Chemical Parameters (Elements)

	Fe (mg/L)	**F (mg/L)**	**As (ppb)**
CIVIL LINE	0.1	0.3	0.015
RAILWAY STATION	0.3	0.2	0.009
PANDEY PATTI	0.2	0.4	0.003
DAV PUBLIC SCHOOL	0.3	0.2	0.007

SADAR HOSPITAL	0.3	0.5	0.005
CHARITRA VAN	0.1	0.3	BDL
NAYA BAZAR	0.2	0.6	0.015
CHHOTA NUAWAN	0.2	0.4	0.012
AHIRAULI	0.2	0.5	0.009
CIVIL COURT	0.1	0.5	BDL

CONCLUSION

1. pH,Turbidity, TDS, Total hardness, Iron, Nitrate, Sulphate, Fluoride for all the Samples are in permissible limit as per the standards for drinking Water by WHO.
2. Calcium present in all the samples are in the permissible limit except in sample of Sadar hospital.
3. Magnesium is found to be high in sample of the Sadar hospital.
4. Chloride is found to be comparatively high in Charitravan but still in permissible limit.
5. Alkalinity was found to be above permissible limit in Charitravan, Ahirauli and Civil court.Rest of the samples were within permissible limit.
6. Arsenic was found to be in permissible limit in all the samples except samples of civil line, naya bazar and chhota nuawan.
7. On the basis of survey conducted randomly in different area regarding public health it was found maximum people are suffering from water related diseases like dirrahoea, dysentery, constipation and bad taste and when they used boiled water for drinking they got some relief.

REFERENCES

1. APHA, 20th ed., Standard methods for the Examination of Water and qwaaste water, American Public Health Association (1998).
2. BIS. *Bureau of Indian Standards Publication IS: 3025*,' *Methods of sampling* Test (Physical and Chemical) for water and wastewater' and Part-44 (1993).
3. Kaur, S. and Joshi, B.D., -Him, *J. Zool.*, **17(1)**, 45-55 (2003).
4. Pahwa, D.V. and Mehrotra, S.N., *Proc. Nat. Acad. Sci.*, India, Sec. **368 (2)**, 157-189.
5. Petak, W.J., *Environ. Managem*., **4**, 287-295 (1980).
6. Singh, S.P., Pathak, D. and Singh, R., *Eco. Env. and Cons*., **8(3)**, 289-292 (2008).
7. (a) Sinha, A.K., Singh, V.P. and Srivastava, K., Physico–chemical studies on river Ganga and its tributaries in Uttar Pradesh –the present status. Pollution and Biomonitoring of Indian Rivers. (ed.) Dr. R.K. Trivedi.(Ed.), ABD Publishers, Jaipur, 1-29 (2000).
   (b) Pandey, P.K and Pandey, G.N., *J. Inst. Engr. India*, **60**, 27-34 n (1980).
   (c.)Tare, V.,Yadav, A.V.S. and Bose, P., *Water Research*, **37**, 67-77 (2003).
8. Sinha, U.P., *Ganga pollution and health hazard,* Inter-India Publication, New Delhi (1986).
9. Zafer, A. and Sultana, N., *Seasonal Analysis in the Water Quality of River Ganga Disaster Ecology and Environment*, Arivnd Kumar (Ed.) Daya Publishing House, India, 57- 62 (2007).

❑