

Variation in some chemical parameters of underground water resources of Bhopal

A. WANGANEO, A.A NAIK and I.A SHEIKH¹

¹Department of Bioscience, Barkatullah University, Bhopal - 462 026 (India)

Department of Limnology, Barkatullah University, Bhopal - 462 026 (India)

(Received: April 18, 2007; Accepted: June 06, 2007)

ABSTRACT

The paucity of sub surface water resources in Bhopal has led to tapping the underground water resources viz., tube wells and hand pumps. On account of the fast development of the human population and industrialization even the underground water resources are affected to a large extent. Keeping in view the welfare of human population dependent mostly on underground water resources an attempt has been made to evaluate their potable status.

It has been found that most of the underground water resources are near alkaline in nature. However, some of the under ground water resources recorded very high conductivity and magnesium values.

On comparing the present values with that of the various standards, the water collected from some of the tube wells is comparatively much better in comparison to the water collected from hand pumps.

Key words: Potable quality, Hand pumps, Tube wells.

INTRODUCTION

The quality of drinking water in Indian cities has deteriorated in the recent years mainly due to growing population, unplanned growth of cities coupled with no proper sewage system leading to poor disposal of the waste water, both from industrial and household activities, Ghazali (1992).

On account of the paucity of open water resources for potable purpose, groundwater resources are being tapped profusely throughout the year. The over use of underground resources has led to number of problems and invites attentions for their conservation and maintenance of their potable quality as most of the ailments in India (70%) such as jaundice, cholera, diarrhoea, dysentery and typhoid etc., are caused by the consumption of polluted water, Rehman (2003). Somashekar et al.

(2000) in their study conducted in a rural district of Bangalore reported that 80% of wells are unsuitable for potable purpose in terms of hardness, while 50% and 20% were not fit for the drinking purpose on account of magnesium and nitrate respectively. Since no study of such type has been conducted in Bhopal as such the necessity was felt to conduct the work.

MATERIAL AND METHODS

Water samples of various hand pumps and tube wells from fourteen sites were collected in polythene bottles as per the standard procedure and were transported to laboratory for chemical analysis. The chemical analysis was carried out following the methods as given in APHA (1995), pH and conductivity values were measured with portable digital meters-Systronics.

Table 1: Important chemical characteristics of underground water samples.

Parameter	Units	Hand pumps													
		Tube well							Hand pumps						
		X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂	X ₁₃	X ₁₄
pH	-	6.2	8	7.3	7.6	7.4	7	7.7	7.2	8	7.6	6.9	6.6	6.7	6.8
TDS	mg/l	420	490	570	540	460	1220	220	580	790	930	580	280	700	280
Electric Conductivity	µS	660	790	920	860	730	1900	340	900	1310	1470	900	450	1110	440
Total Alkalinity	mg/l	250	338	430	350	320	348	174	532	388	228	410	220	310	190
Total Hardness	mg/l	200	190	390	240	274	352	136	710	760	412	226	170	140	230
Calcium hardness	mg/l	58.87	168	58.87	67.28	195.3	54.66	27.75	126.15	619.5	235.2	69.8	54.66	37.84	71.48
Magnesium hardness	mg/l	141.1	22	331.1	172.7	78.7	297.34	108.3	583.85	140.5	176.2	156.2	115.34	102.2	158.52
Chloride	mg/l	66.99	89.91	79.99	105	74.92	84.99	19.99	359	309.69	324	105	44.99	44.99	139.99

X₁= Ibrahimpura Chowk; X₂ = Nadeem road Ibrahimpura; X₃ = Bawaria Kala-II; X₄ = Narayan Nagar; X₅=6 No. Bus stop; X₆ = Baghswania; X₇ = Bag Mugalia; X₈ = Bawaria Kala-I; X₉ = Pipaliya-I; X₁₀ = Pipaliya-II; X₁₁ = Janghirabad; X₁₂ = Ravishankar Nagar; X₁₃ = Budhwara; X₁₄ = Itwara.

Table 2: Variation in chemical parameters on average basis in comparison to various standards

Parameter	Units	Tube well			Hand pumps			Standards							
		Min	Max	Mean	Min	Max	Mean	WHO		ICMR		BIS			
								HDL*	MPL**	HDL*	MPL**	HDL*	MPL**	HDL*	MPL**
pH	-	6.2	8	7.27	8	6.6	7.19	7-8.5	6.5-9.5	7-7.5	6.5-9.2	7-8.3	8.5-9	7-8.3	8.5-9
TDS	mg/l	420	570	505	220	1220	604	500	1000	500	1500	500	2000	500	2000
Electric Conductivity	µS	660	920	807.5	340	1470	633.5	-	-	-	-	-	-	-	-
Total Alkalinity	mg/l	250	430	342	174	532	312	120	250	120	250	200	600	200	600
Total Hardness	mg/l	190	390	255	140	760	341	100	500	200	600	200	600	200	600
Calcium hardness	mg/l	58.87	168	88.25	27.75	619.5	149.23	75	200	75	200	75	200	75	200
Magnesium hardness	mg/l	22	331.1	166.72	78.7	583.85	191.71	30	150	50	200	50	200	50	200
Chloride	mg/l	66.99	105	85.47	19.99	359	150.75	200	600	200	1000	250	1000	250	1000

WHO: World Health Organization; ICMR: Indian Council of Medical Research;

BIS: Bureau of Indian Standards; HDL*: Highest Desirable Limit. MPL**: Maximum Permissible Limit.

RESULTS AND DISCUSSION

Determination of chemical characteristics is essential for assessing the suitability of water for drinking purpose. Present work has been compared with the standards laid down by various agencies such as WHO, ICMR and BIS. The results of the present study are given in Table: 1. The observed pH values ranging from 6.2-8 show that the water samples were near neutral to slightly alkaline. These values are within maximum permissible limit prescribed by WHO, ICMR and BIS (Table: 2).

The overall conductivity values ranged from 340-1900 μ S. The conductivity values of tube wells ranged between 660-920 μ S, while, the conductivity value of hand pumps ranged from 340-1900 μ S (Table.2). Very high electric conductivity values were recorded in four hand pump samples (Table.1), which might be on account of underground minerals. No prescribed standards are suggested by WHO, ICMR and BIS for electrical conductance of water for drinking purposes, so no comparison can be made from observed values.

TDS values of the water samples ranged between 220-1220mg/l. The TDS values of some of the samples (X_1 , X_2 among tube wells and X_5 , X_7 , X_{12} , X_{14} among hand pumps) were found to be within the highest desirable limits as per WHO, ICMR and BIS, thus recording that out of 14 samples only six samples were found to be safe for drinking purpose. TDS value of sample X_6 was found to exceed even the maximum permissible limit as per WHO.

Total alkalinity values of all the water samples varied from 174-532mg/l. The values exceeded highest desirable limit except one (174 mg/l recorded in sample X_7). In most of the samples

(X_2 , X_3 , X_4 , X_5 , X_6 , X_8 , X_9 , X_{11} , X_{13}) the total alkalinity values exceeds the maximum permissible limit as per the specification WHO and ICMR. So from the alkalinity point of view, quality of water samples of the above mentioned sites belonging to both hand pumps and tube wells is of very poor quality.

The calcium hardness values ranged between 27.75-619.5mg/l. The values of samples X_9 and X_{10} exceed the maximum permissible limit as per WHO, ICMR and BIS while in most of the samples calcium hardness values were even below the highest desirable limits even as specified by WHO, ICMR and BIS.

Magnesium hardness values of the samples varied between 22-383.85mg/l. The values of the sample X_3 , X_6 and X_8 exceed the maximum permissible limit set by WHO, ICMR and BIS whereas all other samples have the value within the maximum permissible limit.

Total hardness value varied from 136-760mg/l. Total hardness of water samples X_8 and X_9 exceed the maximum permissible limit according to WHO, ICMR and BIS and the values of remaining twelve samples were within the maximum permissible limit as per WHO, ICMR and BIS.

Chloride content of all the samples ranged from 19.99-350mg/l which is within the maximum permissible limit as prescribed by WHO, ICMR and BIS.

The present study reveals that the water collected from some of the tube wells is comparatively much better in comparison to the water collected from hand pumps.

REFERENCES

1. APHA. Standard methods for the examination of water and wastewater. American Public Health Association Washington, D.C. (1995).
2. Attiqur Rahman, Assessing water quality from Jal Nigam hand pumps in Aligarh City. *Nature Environment and Pollution Technology*, 2(2), 241-244 (2003).
3. BIS, Drinking water specification (first revision) First reprint. Bureau of Indian Standards. IS: 10500:1991 (1992).
4. Ghazali, F.A. Poisoned waters, mindless industrialization polluting rivers. *Nation and the World*, 15th Feb. pp. 28-29

- (1992).
5. I.C.M.R. Manual of standards of quality drinking water supplies. Indian Council of Medical Research. 2nd ed. Special report series No. 44, New Delhi (1975).
 6. Somashekar, R.K. Ground water chemistry of Channapatna Taluk (Banglore rural district) Regression and cluster analysis. *Journal of Environment and Pollution*. 7(2): 101-09 (2000).
 7. W.H.O. Guidelines for drinking water quality, W.H.O. Geneva. Vol. 1, (1984).