

NOTE

Biochemical Evaluation of Groundwater of Karond Area of Bhopal, India

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Biochemical analysis of groundwater (bore-well) of Karond area of Bhopal city has been studied in winter, summer and monsoon season for one year 2003–04. Two readings have been observed in one season for preliminary analysis of water quality index. Temperature, pH, electrical conductivity, free CO₂, chloride, total alkalinity, total hardness, Ca-hardness, Mg-hardness were reported in the range of 21–32.0, 6.4–7.6, 282–680 μ mhos/cm, 6.00–36.0, 78–128.4 ppm, 118.6–248, 58.0–104.8, 36–74 and 14.2–32.8 ppm, respectively. While DO, BOD, COD, NO₃⁻ and SO₄²⁻ range from 1.12–1.64, 2.00–3.2, 20.4–78.6, 3.6–11.2 and 32–70.2 ppm. MPN count index were noted in the range of 6.00–980.0 at different sampling stations.

Key words : Biochemical, Groundwater, Bhopal.

The natural quality of hand-pumps water tends to be degraded by human activities and over-pumping and some geological changes. Municipal and sewage water may enter into aquifer or water resources of bore-wells by percolation. Hence, it has become very important in the public interest to regularly assess and analyze the water quality of the low lying and densely populated area of Karond in Bhopal. Geo-chemistry and topography of the study area plays an important role in the groundwater occurrence. The major sources of pollution are human, animal, industrial and agricultural activities and wastes. During the drought of 1986–87 in Bhopal Division, surface water resource disappeared in many areas; hence the drilling of thousands of new bore-wells became a key factor during the critical period.

Bhopal is situated on 23°16' N latitude and 77°26' E longitude on hard pink red sandstone of Vindhyan region. Bhopal is the picturesque capital of M.P. and is known as the "City of Lakes". The average rainfall recorded is about 1156 mm/year. Sampling of 9 bore-wells, TW1 Berasiya bus stand, TW2 Kaji Camp, TW3 Goutam Nagar Police Thana, TW4 Sindhi Colony, TW5 Geetanjali College, TW6 Housing Board Colony, TW7 Nariyal Kheda, TW8 Arif Nagar and TW9 Karond Choraha have been chosen for the present study. Samples were collected seasonally in 2 L clean jerrycans in 2003–04. The methods applied for analysis are usually as prescribed earlier¹⁻³.

In the present study, temperature ranged from 22–31°C. Temperature of water influences the biological reactions in water. Higher values of temperature accelerate the chemical reactions in water. pH indicates the intensity of acidity and alkalinity and measures H⁺ ions in water. In this study, minimum pH 6.4 and

maximum 7.6 was observed in summer and monsoon seasons. Electrical conductivity measures the dissolved ions; it ranged from 284–644 $\mu\text{mhos/cm}$. Conductivity of water is the capacity to carry an electrical charge and varies both in number and types of ions; minimum value was recorded at TW7 and maximum at TW8. Groundwater is extra rich in CO_2 , as water comes from percolations through various strata and absorbs a large amount of free CO_2 . It ranged from 6.0 in TW1 to 644 in TW8 ppm. In this study, chloride, total alkalinity, total hardness, Ca-hardness and Mg-hardness ranged from 78.1–124.2, 119.6–244, 58.4–112.6, 36–76.8 and 20.2–35.8 ppm, respectively at different sampling stations. Higher values of alkalinity were due to leaching of soil during natural filtration of water from sewage. Hardness is the result of geological formation of the water sources. The findings are similar to those of Kataria *et al.*^{4,5}.

Dissolved oxygen is the primary cause of corrosion of pipes. Highest BOD values may attribute to the stagnation of water body leading to the absence of self-purification cycle. DO and BOD here ranged from 1.12–1.84 and 2.0–3.6 ppm, respectively.

TABLE-1
BIOCHEMICAL ANALYSIS OF BORE-WELLS WATER OF KAROND AREA OF
BHOPAL DURING 2003–2004

Parameters	Unit	Mean seasonal values									
		TW1	TW2	TW3	TW4	TW5	TW6	TW7	TW8	TW9	
Temperature	C	26.0	24.2	22.0	22.0	31.0	29.4	28.2	26.5	26.0	
pH	pH scale	6.4*	6.8	6.7	6.7	6.9	6.8	6.8	7.2	7.6	
Electrical conductivity	$\mu\text{mhos/cm}$	478	498	472	472	508	512	316	284	644	
Free CO_2	ppm	6.0*	6.4	7.2	7.2	7.8	6.2	6.4	6.0	36.0	
Chloride	ppm	100.4	102.6	94.6	94.6	96.4	78.10	118.64	124.2	121.6	
Total alkalinity	ppm	146.0	144.0	136.0	136.0	142.0	204.0	218.0	244.0	119.6	
Total hardness	ppm	64.2	58.4*	62.4	62.4	60.8	62.4	102.8	112.6	78.8	
Ca—H	ppm	38.0	36.0*	42.0	42.0	40.6	38.6	74.0	76.8	49.8	
Mg—H	ppm	26.2	22.4	20.4	20.4	20.2	23.8	28.8	35.8	28.6	
Dissolved oxygen	ppm	1.2	1.12*	1.36	1.36	1.44	1.6	1.62	1.80	1.84	
BOD	ppm	2.4	2.24	2.28	2.28	3.1	3.6	2.0	2.4	2.08	
COD	ppm	50.0	56.4	78.0*	78.0	20.4	24.8	43.6	74.4	58.0	
Nitrate	ppm	4.2	4.5	3.8	3.8	11.2	11.6	6.8	7.9	8.4	
Sulphate	ppm	36.0	36.4	32.0	32.0	33.0	68.0	52.0	54.8	64.0	
MPN	ppm/100 mL	3.0*	4.2	14.0	14.0	4.0	92.0	984.0	980.0	720.0	

Sampling stations:

TW1 = Berasiya Road Bus stand, TW4 = Sindhi Colony, TW7 = Nariyal Kheda = Minimum value

TW2 = Kaji Camp, TW5 = Geetanjali College, TW8 = Arif Nagar = Maximum

TW3 = Goutam Nagar Police Thana, TW6 = Housing Board colony, TW9 = Karound Choraha.

Increase of COD values is due to the pollution of input zones³⁻⁸. In the present study, COD has been found in the range of 20.4–78.0 ppm. Nitrate concentration in groundwater is found due to leaching of nitrate with percolation of water ranged from 3.8–11.6 ppm. Sulphate is an important constituent of hardness with Ca and Mg. Excess amount of sulphate in water has cathartic effect of human health⁶, SO_4^{2-} in this study has been reported in the range of 32–68.0 ppm. For the estimation of the number of presumptive coliforms (MPN count) present in water by inoculation of appropriate volume of a number of tubes of medium (MacConkey Broth) 10, 1 and 0.1 mL of sample inoculated in 3 sets of 5 test tubes each containing 10 mL of medium on inoculation, it was assumed that each tube receives 1 or more viable organisms in the inoculum to show growth and a (+)ve reaction to the medium used. MPN ranged were in this study from 3.0–984 index/100mL.

Most of the parameters were found within the permissible limits recommended by WHO^{7, 8} while MPN was found beyond the limits of ISI⁹.

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