Int. J. Chem. Sci. : 3 (3), 2005, 407–414

PHYSICO – CHEMICAL STUDIES AND WATER QUALITY INDEX OF GROUND WATER NEAR MURGI NULLAH OF OLD AURANGABAD CITY

M. B. UBALE, J. J. CHAMARGORE, MAZAHAR FAROOQUI[a], and S. B. PAKHARE

Department of Chemistry, Vasantrao Naik Mahavidhyalaya, AURANGABAD (M.S.) INDIA
[a]Department of Chemistry, Aurangabad College for Women, AURANGABAD (M.S.) INDIA

ABSTRACT

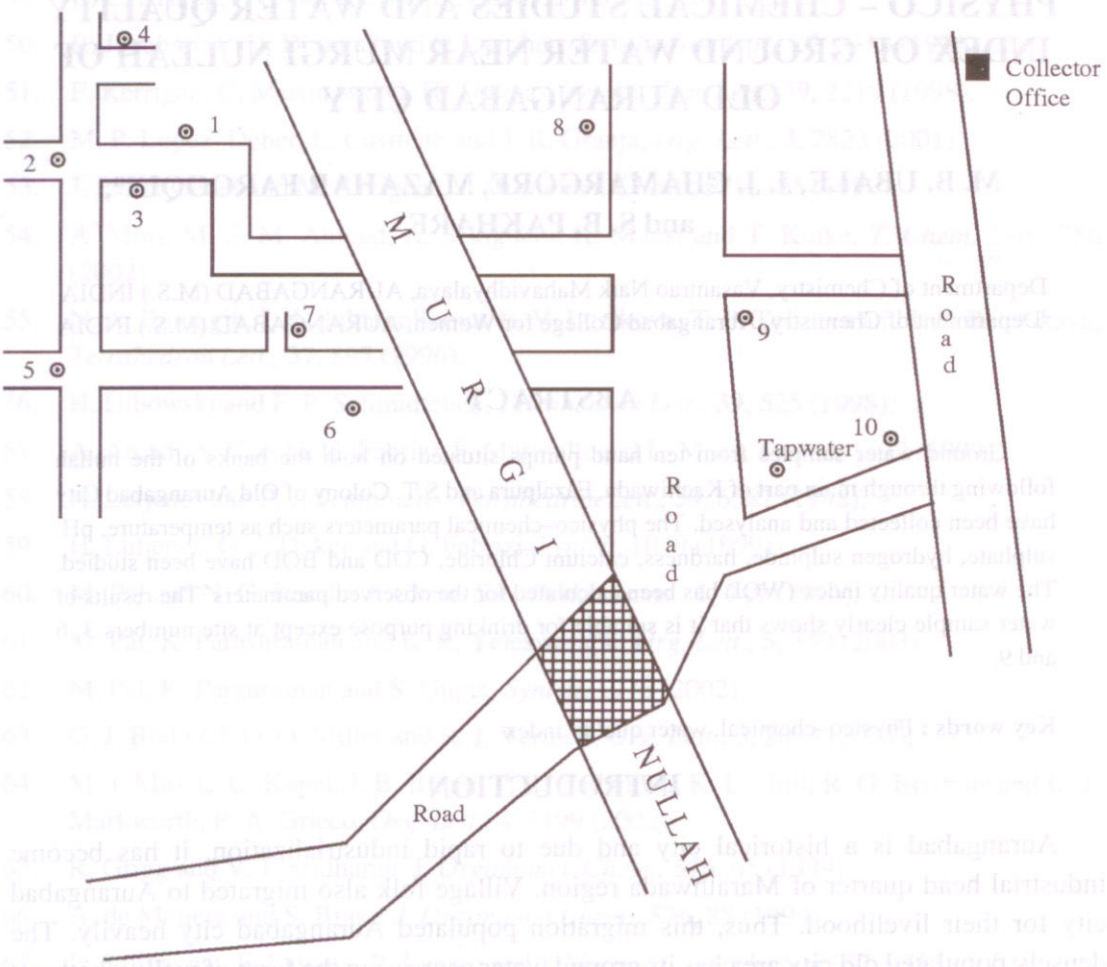
Ground water samples from ten hand pumps situated on both the banks of the nullah following through main part of Kachiwada, Fazalpura and S.T. Colony of Old Aurangabad City have been collected and analysed. The physico–chemical parameters such as temperature, pH, sulphate, hydrogen sulphide, hardness, calcium Chloride, COD and BOD have been studied. The water quality index (WQI) has been calculated for the observed parameters. The results of water sample clearly shows that it is suitable for drinking purpose except at site numbers 3, 6 and 9.

Key words : Physico–chemical, water quality index

INTRODUCTION

Aurangabad is a historical city and due to rapid industrialization, it has become industrial head quarter of Marathwada region. Village folk also migrated to Aurangabad city for their livelihood. Thus, this migration populated Aurangabad city heavily. The densely populated old city area has its ground water sources, in the form of wells which are situated on the banks of the rivulets. These rivulets have now become nullah carrying the domestic sewage. Naturally these groundwater resources such as wells, handpumps, borewells etc. along these riveulets, the water quality is lively to be affected adverely, due to percolation or see page from the nullahs.

Sampling sites selected are Kachiwada, Fazalpura and S.T. Colony from old Aurangabad city area. These sampling sites were at the distance at about 50 to 100 feet from the sewage from flow of the nullah. The work, was therefore planned to investigate and assess the existing quality of the ground water regarding its suitability for drinking and agricultural purpose and also to find out, whether the groundwater is affected by domestic sewage in the region.



Site No ⊙

1 - Boring, Kachiwada
2 - Handpump, Kachiwada
3 - Mahadev Mandir Handpump
4 - Karalyaaya - Well
5 - Laxminarayan Mandir Handpump
6 - Chouse Colony Boring, Fazalpura
7 - Chouse Colony Boring, Fazalpura
8 - Boring, S.T. Colony
9 - Boring, Fajalpura
10 - Boring, Fajalpura

▦ Bridge

Table 1. Physico–chemical analysis of ground water sample of Kachiwada, Fazalpura, S.T. Colony (old Aurangabad city area)

S. No.	Sampling Sites	Temperature (°C)	pH	Sulphate (ppm)	Hydrogen sulphide (ppm)	Hardness (ppm)	Calcium (ppm)	Chloride (ppm)	COD (ppm)	BOD (ppm)
1	Tap – Water	24.0	6.9	7.0	0.051	100.0	34.06	66.74	16	08
2	Site No. 1	27.0	7.1	21.0	0.74	180.0	56.11	154.95	56	18
3	Site No. 2	26.0	7.0	17.0	0.83	200.0	52.19	134.95	136	34
4	Site No. 3	27.0	7.0	15.0	0.84	260.0	65.70	184.94	64	20
5	Site No. 4	22.0	7.2	14.0	1.00	220.0	52.10	124.96	208	62
6	Site No. 5	22.0	7.1	20.0	0.83	190.0	61.72	134.95	112	32
7	Site No. 6	24.0	7.0	18.0	0.79	340.0	64.12	164.94	216	68
8	Site No. 7	26.0	7.1	20.0	0.80	220.0	33.36	154.95	16	10
9	Site No. 8	27.0	7.2	17.0	1.32	180.0	61.72	59.98	08	04
10	Site No. 9	25.0	7.2	15.0	0.74	320.0	56.11	104.96	24	12
11	Site No. 10	26.0	7.0	14.0	0.79	200.0	52.10	94.97	08	06

Table 2. Table showing average, maximum and minimum values of ground water sample (in ppm)

S. No.	Parameter	Average	Maximum	Minimum
1.	Temperature	25.09	27.00	22.00
2.	pH	7.10	7.20	6.90
3.	Sulphate	16.80	21.00	7.00
4.	Hydrogen sulphide	0.79	1.32	0.051
5.	Hardness	219.00	100.00	340.00
6.	Calcium	53.70	65.70	33.60
7.	Chloride	94.97	184.94	59.98
8.	COD	85.60	21.60	0.80
9.	BOD	31.50	6.80	0.04

Table 3. Table showing water quality index (WQI) of the ground water sample

S. No.	Sampling Sites	WQI
1.	Tap – Water	39.53
2.	Site No. 1	56.88
3.	Site No. 2	67.14
4.	Site No. 3	66.22
5.	Site No. 4	93.97
6.	Site No. 5	68.12
7.	Site No. 6	100.46
8.	Site No. 7	47.42
9.	Site No. 8	46.59
10.	Site No. 9	98.39
11.	Site No. 10	40.01

RESULTS AND DISCUSSION

Temperature: Temperature of water depends on the season and on the temperature of the ground with which it is in contact[1]. Temperature is basically important for its effect on the chemical and biological reactions in the organism[2]. A rise in temperature of the water leads to

the speed up of the chemical reactions in water, reduces the solubility of gases, the tastes and odours[3,4]. The maximum temperature was recorded at site No. 1, 3 and 8 and minimum temperature was recorded at site No. 4 and 5.

pH: pH serves as an index to denote the extent of pollution in case of pollution by acidic and alkaline wastes[5]. All chemical and biological reactions are directly dependent upon the pH of water system[6]. In present investigation, pH indicated almost neutral range (6.9–7.2). Maximum pH value of 7.2 was recorded at site No. 4, 8 and 9. The pH limit fixed by Indian standards[7] for bathing and drinking is between 6.5 and 8.5[8]. Hence, the pH of these water samples is within the standards.

Sulphate: Sodium and magnesium sulphates exerts cathartic action and hence, their concentration above 250 ppm in potable water is objectionable[9]. In present investigations, sulphate content was found below permissible value. It showed maximum value at site No. 1, which may be attributed to reduced water level and detergent pollution, as reported to earlier by Varghese et al.[10].

Chloride: Chloride contents in fresh water is largely influenced by evaporation and preciptaion[11]. It is the most trouble some anion in the irrigation water. These are generally more toxic than sulphate to most of the plants and are best indicator of water pollution[12–14]. The maximum value of chloride were recorded at site No. 2. It may be attributed due to seepage of domestice waste discharged in nullah[15]. Chloride contents at all sampling sites were below permissible limit, ISI[7].

Hardness: Hardness of water is due to carbonate, bicarbonate, sulphate, calcium, magnesium, silicates etc.[16]. Hardness of samples at sites No. 6 and 9 showed maximum value, it may be attributed to percolation from the domestic sewage of nullah[17].

Calcium: Calcium is an important nutrient required by the organism. Water with calcium contents above 25 ppm is classified as calcium rich water[18]. All the samples were calcium rich samples. The maximum calcium contents were recorded at site No. 3 and 6 whereas site No. 7 recorded the minimum value of calcium content.

Biochemical Oxygen Demand: Biochemical Oxygen Demand (BOD) values also indicated the degree of pollution[19]. It shows an inverse relationship with DO and COD. BOD represents the biological oxidisable loads present in water[17].

Water body with BOD level exceeding 8 ppm is considered to be polluted[20].

Prati et al.[21] classified water bodies into follow classes depending upon the BOD values as

Class I ..... 1.5 ppm Class II ..... 3.0 ppm

Class III ..... 6.0 ppm Class IV ..... 12.0 ppm

Class V ..... 12 ppm and above.

Referring to this classification, the present study area mostly falls under Class V. The maximum BOD content may be attributed to see page of sewage water added from nullah. Such observations have been reported by other workers also.[22,23]

Chemical Oxygen Demand: Chemical oxygen demand is one of the important parameter used to determine the extent of water pollution[17]. High COD value causes oxygen depletion to the level, which is detrimental to the aquatic life[24].

Hydrogen Sulphide: Sulphide is often present is ground water especially in hot springs and wastewaters coming in parts from the decomposition of organic matter from industrial waste and from bacterial reduction of sulphate[9]. Hydrogen sulphide escaping into air from sulphide containing waste water causes odour nuisance. The threshold odour concentration of H_2S in clean water is between 0.01 and 0.1 ppm[26]. In present investigation, all the sampling sites contain H_2S exceeded 0.1ppm.

Water Quality Index : To determine suitability of the water for drinking purposes, an indexing system is used. It is called water quality index (WQI)[27].

$$WQI = \text{Antilog}\ (W_n \log Q_n)$$

Here, W_n = wt. of pollutant in the sample

$$Q_n = \text{Water quality rating} = \frac{100\ (V_n - V_i)}{(S_n - V_i)}$$

Where V_n = observed value,

V_1 = ideal value, and

S_n = Standard value

The calculated values are shown in Table 3. The rating of water for drinking purpose (according WQI of water) can be shown as:

WQI	Water Quality Rating
0–25	Excellent
26–50	Good
51–75	Poor
76–100	Very Poor
Greater than 100	Unfit for drinking purpose.

It is clear from the Table 3, that samples from three sites (Site No. 7, 8 and 10) fall under good water quality rating. The remaining water samples from different sampling sites either fall in poor or very poor water quality rating. The sample from site No. 6 i.e. from Chouse colony boring, Fazalpura is unfit for drinking purpose as its WQI is above 100 (100.46).

REFERENCES

1. R. K. Trivedy and P. K. Goel, "Chemical and Biological Methods for Water Pollition" Enviro. Pub., Karad, India (1984).
2. R. N. Trevedi, and Shantranjay Kumar Singh, ''Water Resources and Quality Management", Commonwealth Pub., Delhi (India) pp 75–76.
3. D. Kelin, ''River Pollution. Chemical Analysis'', Butterworths Sci. Pub. London, U.K. (1959).
4. U. N. Mahida, ''Water Pollution and Disposal of Waste Water on Land'', Tata McGraw Pub. Co. Ltd, India (1981).
5. P. K. Saxena, S. Jobben and R. Sahai, Geobios. **15** 107 (1988).
6. A. Sreenivason, F. A. O. Fish Rep., **44(3)**, 101 (1967).
7. ISI, ''Tolerance Limit for Inland Surface Water Subject to Pollution''. IS 2296, New Delhi (1974).
8. L. S. Elango, Ramchandran and Y. S. R. Chowdary, Ground Water Quality in Coast al Regions of South Madras. Indian J. Environ. Hlth., **34**, 318 (1992).
9. Neerj, 'Manual on Water and Wastewater Analyses' National Environment Engineering Research Institute, Nagpur (1979).
10. M. Varghese, A. Chauhan and L. P. Naik Poll. Res., **11 (2)**, 95 (1992).
11. P. C. Mishra and M. C. Dash, Poll. Res., **8 (3)** (1989).
12. K. Vijayram, S. R. Vyasugi, S. Chitra and U. Asha, Poll. Res., **9**, 133 (1990).
13. T. R. Bhaskaran, Geo Miller and Co. Pvt. Ltd., New Delhi.
14. H. Rai, Archiv, Fish Hydrobiol. **75**, 369 (1979).
15. R. N. Trivedi and Shatranjay Kumar Singh, ''Water Resources and Quality Management'' Commonwealth Pub., New Delhi (India) pp 75–76.
16. V. S. Lomte and M. B. Desmukh, Dr. Babasaheb Ambedkar Marathwada University, J. Sci., **XXVIII**, 43 (1998).
17. D. G. Dhuley and M. B. Ubale, Dr. Babasaheb Ambedkar Marathwada University, J. Sci., **XXX**, 1 (2000).
18. W. Ohle, Arch Hydrobidogia, **26** : 386 (1934).
19. S. R. Mishra, and D. N. Saksena, Poll. Res., **8 (2)** 77 (1990).
20. D. M. Martin, ''Marine Chemistry'', Vol. 1, Macel Dekker Inc., New York.
21. L. Prati, R. Pavanello and P. Pasarin, Water Res., **5** 741 (1983).

22. L. W. Richard, Medicine, New England J. **275**, 19 (1996).

23. D. P. John, Proc. Fish Ohio Water Clinic Ohio State University, Eng. Series Bull., **147**, 34 (1952).

24. R. B. Ponda, B. K. Saha, B. K. Sinha, A. Nayak and Rajan Behera, Poll. Res., **8 (4)**, 195 (1980).

25. Shree Ramsingh and Vinodkumar Srivastava, Poll. Res., **7(3–4)** 19 (1980).

26. Thomas Zachariah, Poll. Res., **11(4)**, 231 (1992).

27. M. Dasgupta and K. M. Purohit, Poll. Res., **20(1)**, 103 (2001).

Accepted : 22.2.2005