ASSESSMENT OF GROUND WATER QUALITY OF AMRAVATI CITY OF MAHARASHTRA: INDIA

Vaibhav R. Dhawale¹ and Shrikant M. Harle²

*Assistant Professor, Department of Civil Engineering
Prof Ram Meghe College of Engineering and Management, Badnera, Maharashtra, India
{E-mail : 'vaibhavdhawale@gmail.com', 'shrikantharle@gmail.com'}*

Abstract

Water is the most important parameter to influence the climate and human life. The necessary treatment to the water should be given if the water is found to be of bad quality depending upon the different parameters according to WHO & BIS. The effects of different industrial area, mines, etc have the effect on the quality of water. It is very necessary to check the ground water quality. There are many parameters in terms of physical, chemical and bacteriological are studied by many researchers. To prevent any water borne diseases education on hygienic conditions is needed. No specific parameter was found to be exceeding the prescribed limit by higher values. The exceeding parameters in some cases like the hardness, alkalinity and low fluoride concentrations can be given proper treatment in order to make it suitable for drinking purposes. Therefore the ground water quality in Amravati city found to be satisfactory for many parameters.

Key Words : Assessment, Water quality, Parameters, Physical, Chemical

1. Introduction

The health of the residents in the cities, township, etc is very important. It is very essential that the health risk assessment in terms of the quality of drinking water should be properly carried out. It shall be hazardous if the drinking water is of bad quality. There are many studies carried out in the researches. The health risk control indices of source of the water and then the scientific basis are provided in the study [1].

The water borne diseases may occurred due to the use of contaminated water and therefore the quality of water should be checked with the parameters like temperature, pH, turbidity, salinity, nitrates, phosphates, etc as studied [2]. The water quality depends upon the type of pollutant, the self purification capacity of water, etc. The rapid urbanization as well as industrialization is the challenges to keep the water quality of the drinking water sources as explained [9].

The effect of mining on the quality of drinking water in South Africa was studied [3]. The different samples of water were collected and then analysis is done with respect of physical and chemical parameters and six trace metals. It was observed that the mining effect was observed in the quality of water in terms of increase in the concentration of arsenic and iron contents.

The physical, chemical and bacteriological properties are checked of drinking water for sampling sites in Philippines. Color, odor, pH, total dissolved solids, salinity, dissolved oxygen and nitrite are the parameters checked for drinking water as studied [5].

The regular monitoring of water quality is needed to have good health of citizens. This regular monitoring prevents

different diseases as well as it checks the any water resources if there is any pollution. Also the waste management and education on the maintenance of hygienic conditions is required to prevent any water borne diseases as studied [6]. The water safety plan (WSP) is a concept used for risk management and risk assessment; it was used in the Potugese multi-municipal water company. Because of this WSP the improvement of technical operation, performance and good understanding of water quality control was the output as studied [7].

For effective pest control and artificial agrochemicals; the pesticides were used as it is used for the growth. The public health and environmental pollution like water pollution is the concern and therefore the normal distribution analysis (NDA) is used to find out the distribution pattern on the parameters of quality control of water as studied [8].

2. Methodology

The water samples of different regions of the Amravati city of Maharashtra state in India are analyzed. The characteristics were analyzed are included like pH, odour, taste, colour, transparency, total dissolved solids, conductivity, dissolved oxygen, salinity, total hardness, total alkalinity, total acidity and fluorides [10]. The recommendations given by WHO (World Health Organization) is the standard considered for the present study. The sampling locations of Amravati city of Maharashtra state in India has been studied [11].

The table no. 1 shows the details about the different site location, table no.2 to table no.11 gives the details about the parameters of water for sample no.1 to sample no.10 respectively.

Table 1: Site of sample collection

Sr. No.	Sample no.	Site name	Sr. No.	Sample no.	Site name
1	S1	Prabhat colony	6	S6	Saturna
2	S2	Ekviravihar	7	S7	Chaprasipura
3	S3	Ambadevi	8	S8	Badnera
4	S4	Morshi	9	S9	Camp
5	S5	Navsari	10	S10	MIDC

The observations of samples at different locations are mentioned in the following tables

Table 2: Observation sheet of sample number S1

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	29	8.06	Y	Y	0.025	98.8	419
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	139	3.8	6.7	194	180	240	0.58

Table 3: Observation sheet of sample number S2

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	30.3	8.16	Y	Y	0.007	95.4	349
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	448	2.9	2.32	165	195	220	0.46

Table 4: Observation sheet of sample number S3

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	29.0	7.95	Y	Y	0.015	99.1	493
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	214	2.9	5.78	223	213	216	0.6

Table 5: Observation sheet of sample number S4

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	31.1	7.85	Y	Y	0.013	97	453
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	190	2.2	5.69	198	196	165	0.56

Table 6: Observation sheet of sample number S5

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	29.6	7.68	Y	Y	0.009	99	187
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	396	2.2	2.56	290	220	230	0.7

Table 7: Observation sheet of sample number S6

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	30.1	7.64	Y	Y	0.008	99.2	352
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	930	2.4	4.63	320	100	180	0.72

Table 8: Observation sheet of sample number S7

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	29.8	7.63	Y	Y	0.015	98.3	373
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	626	2.1	4.69	350	110	250	0.8

Table 9: Observation sheet of sample number S8

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	31.2	8.15	Y	Y	0.016	98.6	185
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	352	1.9	2.3	370	245	250	0.81

Table 10: Observation sheet of sample number S9

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	30.9	8.5	Y	Y	0.002	99.7	272
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transperancy	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	258	2.4	3.21	188	180	220	0.52

Table 11: Observation sheet of sample number S10

Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transparency	TDS
Unit	°C	--	Unobjectionable	Agreeable	Hazen	%	ppm
Result	31	8.35	Y	Y	0.017	98	438
Parameter	Temperature	pH	Odour	Taste	Colour Concentration	Transparency	TDS
Unit	uS/cm	ppm	Ppm	Ppm	Ppm	ppm	ppm
Result	496	1.86	2.32	320	206	216	0.7

pH tests:-It was found that pH of all 10 water sample were very well within the permissible range prescribed by BIS which is 6.5-8.5. Sample from site S₉ had its pH 8.5, touching the upper limit of permissible pH of water. Among the 10 samples, least pH was found in sample S₇, it came to be 7.65. Samples from site S₅, S₆ and S₇ had their pH very close to each other as 7.68, 7.64 and 7.63 respectively. All other samples had their pH normal i.e. in the range.

Odour determination:-In the whole assessment, no sample was found displeasing or having any foul odour. Temperature of water at the time of tests used to be around 30°C, still at this temperature, no objectionable odour from any of the sample was detected.

Taste determination:-As odour and taste work together, it was easily predictable from the odour itself that the taste results of samples wouldn't be objectionable as the odour of samples were unobjectionable. After the analysis all the samples were found to be agreeable in taste. Variation of taste was observed which was due to hardness and dissolved solid variations.

Colour tests:- In the assessment, systronics water analyzer was used for colour determination in which three colour filters viz. red, green and blue were used. Average absolute colour presence was determined. None of the sample exceeded or even reached the limit. Every sample was below 0.1 unit.

Transparency tests:- In the analysis, samples were tested for transparency in the water analyzer using colour filters and average transparency obtained from each filter was noted down as the result. Out of all the samples tested for transparency, sample S₉ had maximum transparency of 99.7% and least transparent sample was S₂ with 95.4% transparency.

Total dissolved solids tests:-In the analysis, no sample was found with TDS exceeding the permissible limit. Sample S₃ was found to be very close to the permissible limit. Sample S₃ had its TDS reading as 493 ppm and the

permissible limit given by BIS is 500 ppm. Least TDS reading was observed at sample S₈ as 185 ppm and S₅ as 187 ppm. All other samples had their TDS ranging between 270 ppm to 420 ppm.

Conductivity tests:-Conductivity of the water should be up to 50 µS/cm. The analysis of samples had all the sample results more than 50 µS/cm. Sample S₆ had maximum conductivity as 930 µS/cm and sample S₁ had least conductivity as 139 µS/cm. All other samples had their readings ranging from 190 to 500 µS/cm.

Dissolved oxygen tests:-From the analysis, sample S₁ had the maximum dissolved oxygen as 3.8 ppm. Sample S₃ and S₄ had their DO amounts as 2.9 ppm and S₅, S₆ had DO amounts equal to 2.2 ppm. Least DO was found at sample S₁₀ as 1.86 ppm. Range of DO was from 1.86 to 3.8 ppm.

Salinity tests:-Salinity is observed due to dissolved salts in water. In the analysis, salinity range was from 2.3 ppm as minimum to 6.7 ppm. Sample S₁ had maximum salinity as 6.7 ppm and S₈ least salinity equal to 2.3 ppm.

The hardness tests:-Permissible limit of hardness is 300 ppm. In the analysis, four samples were found to be exceeding the permissible limit. Sample S₆, S₇, S₈ and S₁₀ had their hardness as 320 ppm, 350 ppm, 370 ppm and 320 ppm respectively which is greater than the prescribed limit of BIS. Maximum hardness was found in sample S₈ as 370 ppm and least hardness was found in sample S₂ as 164 ppm. Sample S₅ was close to the limit with hardness 290 ppm. Rest other samples were well within the limit.

Total alkalinity tests:-Alkalinity of a solution is its capacity to resist the change in its pH when acid is added in the solution. In the analysis of samples, four samples were found to be exceeding the limit of alkalinity which is 200 ppm. Sample S₃, S₅, S₈ and S₁₀ had their alkalinities as 213 ppm, 220 ppm, 245 ppm and 206 ppm respectively. Maximum alkalinity was found in sample S₈ as 245 ppm and minimum alkalinity was found in sample S₆ as 100 ppm.

Total acidity tests:-Quantitative capacity of water to react with the bases is the total acidity of the water. In the analysis, acidity of the water samples was in the range of 165 ppm to 250 ppm. Two samples viz. S7 and S8 had their acidity results as 250 ppm. Sample S4 had the least acidity reading as 165 ppm.

Total acidity tests:-Quantitative capacity of water to react

with the bases is the total acidity of the water. In the analysis, acidity of the water samples was in the range of 165 ppm to 250 ppm. Two samples viz. S7 and S8 had their acidity results as 250 ppm. Sample S4 had the least acidity reading as 165 ppm.

The following table no. 12 & 13 shows the analysis of groundwater sample S1 to S5 and S6 to S10 respectively.

Table 12: Results of the analysis of groundwater sample (S1 to S5)

Parameter	Unit	WHO values	S1	S2	S3	S4	S5
Temperature	°C	-	29	30.3	29.2	31.1	29.6
pH	Nil	6.5-8.5	8.06	8.1	7.95	7.85	7.68
Odour	Unobjectionable (Y/N)	Y	Y	Y	Y	Y	Y
Taste	Agreeable (Y/N)	Y	Y	Y	Y	Y	Y
Color concentration	Hazen	5	0.025	0.007	0.015	0.013	0.009
Transparency	%	NIL	98.8	95.4	99.1	97	99
TDS	Ppm	500	419	349	493	453	187
Conductivity	uS/cm	50	139	448	214	190	396
D.O.	Ppm	NIL	3.8	2.9	2.9	2.2	2.2
Salinity	Ppm	NIL	6.7	2.32	5.78	5.69	2.56
Hardness	Ppm	300	194	164	223	198	290
Total alkalinity	Ppm	200	180	195	213	196	220
Total acidity	Ppm	NIL	240	220	216	165	230
Fluorides	Ppm	1.0	0.58	0.46	0.6	0.56	0.7

Table 13: Results of the analysis of groundwater sample (S6 to S10)

Parameter	Unit	WHO values	S6	S7	S8	S9	S10
Temperature	°C	-	30.1	29.8	31.2	30.9	31
pH	Nil	6.5-8.5	7.64	7.63	8.15	8.5	8.35
Odour	Unobjectionable (Y/N)	Y	Y	Y	Y	Y	Y
Taste	Agreeable (Y/N)	Y	Y	Y	Y	Y	Y
Color concentration	Hazen	5	0.008	0.015	0.016	0.002	0.009
Transparency	%	NIL	99.2	98.3	98.6	99.7	99
TDS	Ppm	500	352	373	185	272	187
Conductivity	uS/cm	50	930	626	352	258	396
D.O.	Ppm	NIL	2.4	2.1	1.9	2.4	2.2
Salinity	Ppm	NIL	4.63	4.69	2.3	3.21	2.56
Hardness	Ppm	300	320	350	370	188	290
Total alkalinity	Ppm	200	100	110	245	180	220
Total acidity	Ppm	NIL	180	250	250	220	230
Fluorides	Ppm	1.0	0.72	0.8	0.81	0.52	0.7

3. Conclusion

After the whole assessment, comparisons of the results obtained, with the standards it is found that the quality of groundwater of Amravati city is good and the water is fit for human consumption in most of the regions. No specific parameter was found to be exceeding the prescribed limit by higher values. The exceeding parameters in some cases like the hardness, alkalinity and low fluoride concentrations can be given proper treatment in order to make it suitable for drinking purposes. Aesthetically speaking, the quality of groundwater is agreeable without any odour, displeasing taste or colouration. For industrial application, the water needs to be treated for dissolved oxygen and hardness.

References

- [1] Fuquan Ni, Guodong Liu, Jian Ye, Huazhun Ren and Shangchun Yang, November 2009, Arc GIS-based rural drinking water quality health risk assessment, journal of water resource and protection, Issue 1, pages 351-361.
- [2] S. P. Gorde and M. V. Jadhao, December 2013, Assessment of water quality parameters: A review, International journal of Engineering research and applications, Volume 3, Issue 6, pages 2029-2035.
- [3] Cobbina S. J., Myilla and m. Michael K., January 2013, Small scale gold mining and heavy metal pollution: Assessment of drinking water sources in the Talensi-Nabdam district, International Journal of scientific & technology research, volume 2, issue 1, pages 1-5.
- [4] Zuthi M. F. R., Biswas M. and Bahar M. N., May 2009, Assessment of supply water quality in the Chittagong city of Bangladesh, ARPN journal of engineering and applied sciences, vol.4, no. 3, pages 73-80.
- [5] Merle N. Tonog and Marieta M. Poblete, January 2015, Drinking water quality assessment in selected Barangays in Laoang, Northern Samar, Philippines, International journal of environmental science and development, vol.6,no.1, pages 29-33.
- [6] Bina LaxmiJayana, TistaPrasai, Anjana Singh and Kayo Devi Yami, (2009), Assessment of drinking water quality of Madhyapur-Thimi and study of antibiotic sensitivity against bacterial isolates, Nepal journal of science and technology, Issue 10, pages 167-172.
- [7] Jose Manuel Pereira Vieira, July 11-14, 2005, Water safety plans: methodologies for risk assessment and risk management in drinking water systems, The fourth Inter-Celtic Colloquium on hydrology and of water resources, Portugal.
- [8] Joydev Dutta, MridulChetia, J. P. SarmahBaruah and Abani Kumar Misra, 2010, Assessment of drinking water quality in different small tea gardens of Sonitpur district (Assam), India, Archives of applied science research, vol. 2, issue 5, pages 226-238.
- [9] Qing Gu, Jinsong Deng, Ke Wang, Yi Lin, Jun Li, MuyeGan, Ligang Ma and Yang Hong (2014), Identification and Assessment of potential water quality impact factors for drinking water reservoirs, International journal of Environmental research and public health, vol. 11, pages 6079 – 6084.
- [10] NaeemShahid, Zahida Zia, Muhammad Shahid, Hafiz FaiqBakhat, Seham Anwar, Ghulam Mustafa Shah and Muhammad Rizwan Ashraf, (2015), Assessing drinking water quality in Punjab, Pakistan, Punjab journal of environmental studies, vol. 24, no. 6, pages 2597-2606.
- [11] SyedaAzeemUnnisa and M. Nurul Hassan, July 2013, Assessment and evaluation of the quality of drinking water at the consumer end – A study of Hyderabad, Andhra Pradesh, International journal of plant, animal and environmental sciences, vol. 3, issue 3, pages 50-54.
- [12] ChandetrikRaut and Arabinda Sharma, 2011, Assessment of drinking water quality: A case study of Ambala cantonment area, Haryana, India, International journal of environmental science, vol. 2, issue 2, pages 933-945.
- [13] S. Devi and R. Premkumar, 2012, Physicochemical analysis of groundwater samples near Industrial area, Cuddalore district, Tamilnadu, India, International journal of ChemTech research, vol. 4, issue 1, pages 29-34.
- [14] Susan Varughese and Devi Prasad K.V., 2012, Physico-Chemical analysis of groundwater samples in the Varahanadi watershed, India, International journal of environmental sciences, volume 2, issue 3, pages 1662-1669.
- [15] V. T. Patil and P. R. Patil, 2010, Physicochemical analysis of selected groundwater samples of Amalner town in Jalgaon district, Maharashtra, India, vol. 7, issue 1, pages 111-116.
- [16] G. Arunkumar, P. SankaraPitchaiah, G. Sudhakar and Swarnalatha G., April 2015, Physicochemical analysis of selected groundwater samples of Inkollu Mandal, Prakasam district, AndhraPradesh, India, International journal of Engineering research and applications, vol. 5, issue 4, pages 65-70.
- [17] Z. A. Napacho and S. V. Manyele, November 2010, Quality assessment of drinking water in Tameke district (part-II): Characterization of chemical parameters, African journal of Environmental science and technology, vol. 11 (11), pages 775-789.
- [18] PratikshaTambekar, Pravin Morey, R. J. Batra and R. G. Weginwar, 2012, Quality assessment of drinking water: A case study of Chandrapur district (M.S.), Journal of Chemical and Pharmaceutical research, Vol. 4 (5), pages 2564-2570.