RESEARCH ARTICLE

Quality assessment of borewell water: A case study of Gadchandur area in Chandrapur district

Pidurkar RS[1]*, Lanjewar MR[2] and Lanjewar RB[3]

[1]Sardar Patel Mahavidyalaya, Chandrapur, India

[2]Department of Chemistry, R.T.M. Nagpur University, Nagpur, India

[3]Department of Chemistry, Dharampeth M.P.Deo Memorial Science College, Nagpur, India

*Corresponding author email : pidurkar.raju@gmail.com

Manuscript details:	ABSTRACT
  Cite this article as: 	The present study was carried out with a view to have an understanding about the pollution status of water from Gadchandur area (Chandrapur district) particularly water quality in vicinity of industrial area. Evaluation of physico-chemical parameters was carried out. Fifteen samples were collected from various selected sites. The analysis of parameters using standard methods and their comparison with standard values suggested that most of the parameters are within the permissible limit. The present paper accounts water quality of various sites of Gadchandur area in Chandrapur district. **Keywords:** Ground water, physico-chemical parameters, TDS, DO, APHA

INTRODUCTION

Rapid industrialization and urbanization is leading to deterioration of environmental conditions on global scale. In recent years environmental pollution has become a critical problem which affect on atmospheric properties, human health, soil, water, vegetation, animal and the whole ecosystem. Due to intense industrial activities and dense settlement in urban and industrial areas, the environmental pollution becoming growing hazards to human health. Water plays an important role in human life and its elemental composition is important to life processes as it provides all the essential nutrients to living organism. Due to tremendous increase in pollution, technological advancement and industrial growth, the lack of safe drinking water emerge as major problem for significant proportion of global population.

Water is a prime natural resources and a basic human need. The present work is carried out in vicinity of Gadchandur area in Chandrapur district in order to study the water quality. Gadchandur is situated on Eastern side of Maharashtra state and shares the state border of Andhra Pradesh, lies between degree of $19^0 43'N$ $79^0 10'E$, the adjoining districts are Garhchiroli on eastern side, on Southern side Adilabad district of Andhra Pradesh, on western side Yavatmal District. The Gadchandur area falls under the Penganga basin and Wardha river basin.

MATERIALS AND METHODS

***Study Area*:** The Physico-chemical parameters of ground water of 15 stations in Gadchandur area were studied. The water samples were collected from bore wells located in this area. Ultratech, Ambuja, Manikgarh and Murali cement factories are located near this area. The samples were collected in clean polythene bottles without air bubbles, the bottles were rinsed using double distilled water before sampling and tightly sealed after collection and labeled. Analysis of pH, Total dissolved solids, fluoride, iron, nitrate, sulphate, dissolved oxygen, alkalinity, chlorides, total hardness and turbidity was carried out in laboratory and data is reported in Table No. 1.

RESULTS AND DISCUSSION

The samples collected from Gadchandur area were analyzed. The analysis of water samples includes determination of physico-chemical parameters which were analysed in winter [February 2014] season have been shown in Table 1.

Temperature: Temperatures of groundwater samples were measured in-situ. The water temperature was recorded between 28.8^0C to 30.1^0C. The water temperature has close relation to the variation of atmospheric temperature (Sunkad, 2004). Water temperature above 30^0C is unfit for public use (Zajic,1971). Temperature of W3 and W10 were found to be above 30^0C.

pH: pH of water the major ecological factor and is most important in controlling the activities and distribution of aquatic flora and fauna. On an average, pH values of most of the water samples were well within the range given in the WHO recommendations. This shows that all water samples except sample no. W12 were slightly alkaline.

Total Dissolved Solids: The average value of TDS in water samples ranges from 331ppm to 1110ppm. The observations show that the TDS of samples except W3, W4 and W6 are beyond desirable limit.

Turbidity: Turbidity in water may be caused by suspended matter such as clay, slit, finely divided organic and inorganic matter, soluble coloured organic compounds, planktons and other microscopic constituents. Turbidity of W5 and W12 were beyond desirable limit.

Alkalinity: Alkalinity of natural water may be attributed to the presence of salts of weak acids such as bicarbonates, phosphates, silicates and borates (Dara, 2011) which induce buffer capacity and lowering of pH. Alkalinity of different sites in Gadchandur area varied from 115ppm to 227ppm. Alkalinity of W10 was more than desirable limit.

Chlorides: In potable water, the salty taste is produced by chloride concentration and it is variable and dependent on chemical composition of water. In this study, chloride was found in range of 21.99ppm to 199ppm. High concentration of chloride may indicate high concentration of pollutant. The values observed in present study were in the range of permissible limit.

Fluorides: The values of fluoride content of most of the sampling sites were within the permissible limit. It does not cause any dental carries and danger of fluorosis. But sample no. W2, W6, W9 and W13 were having high fluoride content than desirable limit which may cause dental fluorosis and hence the water is unfit for drinking. Sample No. W14 has very low fluoride content which may cause dental carries. Hence it is also unfit for drinking.

Iron: Iron was found ranging from 0.038ppm to 0.999ppm in water samples from study area. Fe content for most of the samples was within the limit which indicates that water is fit for drinking. Fe content of sample no. W5 was very high due to which it is unfit for drinking.

Hardness: Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water (Patil and Patil, 2010). This soap consuming capacity is mainly due to presence of calcium and magnesium ions in the water. Total hardness of different sites in Gadchandur area varied from 144ppm to 732ppm. which shows that water is safe for drinking purpose except sample W2, W7, W8 and W12. The result shows that all the samples were moderately soft except sample W2, W7, W8 and W12 as per WHO's limit.

Nitrates: Nitrate is the more stable oxidized form of combined nitrogen in most environmental media. Most nitrogenous materials in natural waters tend to be converted to nitrate, and, therefore, all sources of combined nitrogen (particularly organic nitrogen and ammonia) should be considered as potential nitrate sources. Drinking water containing more than 45ppm NO_3^- can cause blue baby or methamoglobinemia in

Table 1: Physicochemical parameters of fifteen water samples of Gadchandur area.

Sr. No.	Site Code	Temp. (°C)	pH	TDS (ppm)	Turbidity (NTU)	Alkalinity (ppm)	Cl⁻ (ppm)	F⁻ (ppm)	Fe (ppm)	Total Hardness (ppm)	NO₃⁻ (ppm)	SO₄²⁻ (ppm)	DO (ppm)	C.O.D.	B.O.D.
1	(Thutra) W1	29.5	7.10	530	1.65	157	55.98	1.195	0.221	290	150.2	60	4.0	ND	ND
2	(Gopalpur) W2	28.8	7.28	505	0.54	143	37.99	3.442	0.078	562	12.88	140	4.2	ND	ND
3	(Manoli) W3	30.1	7.34	382	1.79	146	43.99	0.532	0.265	298	16.70	30	3.8	ND	ND
4	(Bailampur) W4	29.2	7.20	331	2.72	115	21.99	0.437	0.240	240	3.98	20	4.0	ND	ND
5	(Gadchandur) W5	29.2	7.12	730	20.5	149	115.96	0.620	0.999	322	7.29	135	3.8	ND	ND
6	(Pimpalgaon) W6	28.9	7.24	418	0.78	118	23.99	1.714	0.073	288	12.65	35	4.0	ND	ND
7	(Bibi) W7	29.3	7.19	974	0.35	150	197.94	0.739	0.043	732	153.39	65	3.8	ND	ND
8	(Nanda) W8	29.3	7.25	776	1.16	144	115.96	0.939	0.162	490	153.41	70	4.4	ND	ND
9	(Awalpur) W9	28.9	7.44	565	0.36	189	53.98	1.715	0.038	334	15.67	60	4.6	ND	ND
10	(Hirapur) W10	30.1	7.35	658	4.36	227	47.99	1.572	0.285	406	17.27	40	4.2	ND	ND
11	(Nokari) W11	29.7	7.17	581	0.69	131	45.99	1.157	0.107	294	9.78	130	4.4	ND	ND
12	(Palgaon) W12	29.1	6.98	1110	5.96	119	199.94	0.658	0.457	490	153.31	380	3.8	ND	ND
13	(Hardona) W13	28.6	7.30	541	1.35	144	39.99	2.154	0.137	368	20.32	50	4.4	ND	ND
14	(Uparwahi) W14	29.3	7.19	573	2.13	148	55.98	0.263	0.231	222	9.06	70	4.0	ND	ND
15	(Mangi) W15	29.5	7.50	525	4.69	153	47.99	1.375	0.171	144	5.64	50	4.2	ND	ND
BIS/WHO		----	6.5–8.5	500	1 – 5	200	250	0.5–1.5	0.300	300	45	200	4 - 6		

infants and gastric carcinomas (Hopps and Feder, 1986; Jalali, 2005) W1, W7, W8 and W12 samples from study area have NO_3^- content above 45ppm which shows high level of pollution.

Sulphates: Water containing high level of sulphates particularly magnesium sulphate and sodium sulphate may have a laxative effect on a person using the water for the first time. In groundwater samples of study area, SO_4^{2-} concentration ranged from 20ppm to 380ppm. The concentrations of SO_4^{2-} in most of the samples were lower than the desirable limit (200ppm) accepted for drinking purpose. Sample no. W12 having SO_4^{2-} content higher than desirable limit is unfit for drinking.

Dissolved Oxygen: In natural and waste water, DO level depends on the physical, chemical and biological activities of the water body. The analysis of DO plays key role in water pollution control activities and waste treatment process control (Day, 2012) DO values of water samples in the study area are ranged from 3.8ppm to 4.6ppm. Some samples shows less amount of DO than BIS values.

CONCLUSION

The results revealed that majority of the sampling stations had permissible range of concentrations of salts while some of them is highly polluted. The parameters in most of the water samples are in normal range and indicated better quality of water. It is advisable that people from this area uses bore well water for domestic purpose.

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