12. Assessment of Some Physico-Chemical Parameters of Drinking Water Samples from Akola (Maharashtra)

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Abstract

Water is an essential and vital component for our life support system. Water is the universal solvent. It can dissolve mineral species present in hard rocks, soft nutrients and also the waste food materials that are consumed by people and animals. The quality of water is a vital concern for mankind since it is directly linked with human welfare. In India, most of the population is dependent on groundwater and surface water as the only source of drinking water supply.

Survey and selection of sites for drinking water samples from bore well and tap water of Akola Municipal Corporation (AMC) was performed. Physico-chemical aspects like- pH, Total Dissolved Solids (TDS), Dissolved oxygen (DO), Dissolved carbon dioxide (DCO_2) and Residual chlorine of collected samples was estimated. Guideline values for drinking water for developing countries given by World Health Organization and Indian Standard (IS: 10500) are taken as base for formulating the local values. The pH value of collected water samples varied between 6.71 to 7.9, which is within the prescribed limit. TDS value of Bore well water and tap water from Akola Municipal Corporation is within limit, but it is very high in hand pump water. Dissolved oxygen content was found satisfactory in all water sources except hand pump water. dissolved carbon dioxide and residual chlorine contents are permissible in every drinking water source of study area. Overall, the water quality in the investigated area is found to be safe for drinking and domestic use.

Keywords: Water, pH, Total Dissolved Solids (TDS), Dissolved oxygen (DO), Dissolved carbon dioxide (DCO_2), Residual chlorine.

Introduction

Ground water has unique features which render it particularly suitable for public water supply. It has excellent natural quality, usually free from pathogens, color and turbidity and can be consumed directly without treatment (Saleem *et al.*, 2012). Drinking water is water intended

for human consumption for drinking and cooking purposes from any source. It includes water supplied by any means for human consumption (IS 10500, 2012). Water that is clear and colorless gives an impression that it is safe for human consumption. This may not be always true as many of the objectionable matter may be present in visible form. These may be added to water either naturally or due to certain activities and therefore it is important to understand their environmental significance (Ramesh kumar and Hemanth, 2018). World Health Organization (WHO, 2022) has recommended guideline values for drinking water for developing countries, which are taken as base for formulating the local values.

Materials and Methods

Study area is Akola city, which is located in Akola District of Maharashtra State, India. It is geographically located at 20.17 to 21.16 North altitude and 76.7 to 77.4 East altitude. Average Rainfall in Akola District is 750 to 1000 mm. (http://maharashtra.gov.in/).

Water samples were collected from five different sites of Akola city as- Jatharpeth (Borewell water), Ramdaspeth (Borewell water), Railway quarter (Tap water of AMC), Panchashil Nagar (Tap water of AMC) and Jatharpeth (Hand pump water) during January 2023 to March 2023. The water samples were analysed for various parameters. Physical and chemical parameters like Colour, Odour, Temperature, pH, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Dissolved Carbon dioxide (DCO_2), Residual Chlorine and Alkalinity have been monitored for drinking water of different locations. The results of the analysed parameters are compared with the related standards for drinking water prescribed by World Health Organization (WHO, 2022) and IS:10500.

Results and Discussion

By hydrological process pure water cycle continuously get recharge. Potable water is primary need of human as it serves as lubricant, regulates body temperature and provides the basis for the body fluids and metabolism. At global level most of the deaths were occurred due to waterborne diseases. Thus, monitoring altered physico chemical parameters is essential to check water quality (Deshmukh and Suradkar, 2022). According to WHO report it suggests that lack of clean drinking water adversely affect the human health and life expectancy. Hence analysis of groundwater becomes necessary.

Temperature: Water temperature is important because most of the physical, chemical and biological characteristics of a surface and groundwater are directly affected by temperature (Arya, *et al.*, 2014). In present study, temperature of drinking water from different source was recorded in the range of 30.4 - 31.3 ^{0}C (Table- 1). It is normal temperature of drinking water.

Pollutants can become more toxic at higher temperatures. The amount of dissolved oxygen becomes lower as the water becomes warmer.

pH : Mainly drinking water pH lies from 6.4 to 8.5. The pH value of collected water samples varied between 6.71 to 7.9 (Table- 1 and Graph- 1 a), which is within the prescribed limit by World Health Organization (WHO, 2022;) and Indian Standard (IS: 10500). The pH of water sample indicates the mild alkaline nature which may be due to presence of bicarbonates which undergo hydrolysis in solution, the alkaline pH of water sample indicates the presence of very weak basic salt (Siddiqui, *et al.*, 2018).

Total Dissolved Solids (TDS) : The TDS in groundwater is due to the presence of Calcium, Magnesium, Sodium, Potassium, Bicarbonate, Chloride and Sulphate ions (Firmal, 2009). The prescribed limit of TDS for drinking water is 500 mg/l (IS: 10500). In the study area TDS of drinking water varied from 105 to 962 mg/l (Table- 1 and Graph- 1 b). Bore well water shows TDS in the range of 105 -130 mg/l. TDS range of tap water from Akola Municipal Corporation is within limit i.e. 217-220. Surprisingly TDS level of hand pump water is very high up to 962. The water with high TDS value indicates that water is highly mineralized. This may be due to inflow of more waste material and presence of microbes and salts. Although TDS is not a primary pollutant, but TDS is used as an indicator of the presence of a broad array of chemical contaminants (Shrivastava, 2014). High values of TDS may affect persons who are suffering from kidney and heart diseases. Water containing high solid may cause laxative or constipation effects (Sasikaran *et al.* 2012). Continuous use of such water may cause weakness, scouring, reduced production, bone degeneration etc.

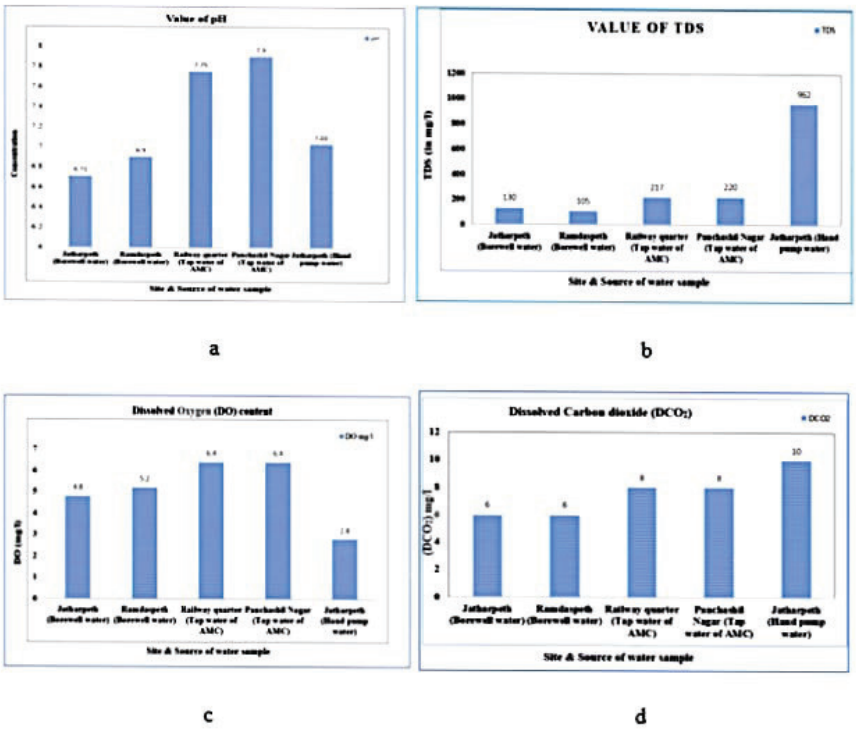
Dissolved Oxygen (DO): The level of dissolved oxygen in water is one of the most important parameters in determining its quality, because it indirectly indicates whether there is some kind of pollution (Ibanez *et al.*, 2008). Healthy drinking water should consist of 6.5- 8.0 mg/l dissolved oxygen. Relatively high levels of dissolved oxygen can lead to a better taste. If DO levels drop below 4.0 mg/l, it's likely that the water is contaminated and unsafe to drink. In the study area, Dissolved oxygen (DO) is ranged from 2.8 to 6.4 mg/l (Table- 1 and Graph- 1c). In Borewell water, oxygen content is in the range of 4.8 to 5.2. Actually, here there are lesser chance of oxygen contact with atmospheric air. In Tap water of Akola Municipal Corporation, 6.4 mg/l Dissolved oxygen content was found. Dissolved oxygen level of hand pump water is very low up to 2.8 mg/l. Low oxygen content in water is usually associated with organic pollution.

Dissolved Carbon Dioxide (DCO_2): Compared with oxygen, the estimation of carbon dioxide in water presents much greater difficulties. This is partly due to the high solubility and rate of diffusion of carbon dioxide in water which makes it difficult to avoid a significant change in concentration when sampling or during the process of estimation (Milburn and Beadle, 1960). In the present study, Borewell water showed 6 mg/l dissolved carbon dioxide, Tap water of Akola Municipal Corporation (AMC) dissolved 8 mg/l CO_2 and Dissolved CO_2 level of hand pump water is highest i. e. 10 mg/l (Table- 1 and Graph- 4). Occurrence of dissolved carbon dioxide in different drinking water sources are in the range of 6 to 10 mg/l, which is in the prescribed limit given by WHO.

Residual Chlorine: In the present study the groundwater sources like borewell and hand pump shows 0.1 ppm residual chlorine, whereas tap water of Akola Municipal Corporation reported 0.2 ppm of residual chlorine. The proportion of residual chlorine in all drinking water sources studied is found to be in normal range. Naturally, chlorides are found as salts such as sodium chloride, potassium chloride, and calcium chloride. Chlorides are leached from different rocks into soil and water due to weathering. Chloride levels in unpolluted waters are generally below 10 mg/litre. Chloride in water may be significantly increased by treatment processes in which chlorine or chloride is used (Shrivastava, 2014).

Table-1: Table showing Properties of various drinking water sources (n=5).

Sr. No.	Sampling points	Colour	Odour	Temp. (°C)	pH	TDS	DO mg/l	DCO_2 (mg/l)	Residual Chlorine (ppm)
1.	Jatharpeth (Borewell water)	---	---	30.8	6.71	130	4.8	6	0.1
2.	Ramdaspeth (Borewell water)	---	---	30.4	6.90	105	5.2	6	0.1
3.	Railway quarter (Tap water of AMC)	---	---	30.7	7.75	217	6.4	8	0.2
4.	Panchashil Nagar (Tap water of AMC)	---	---	31.1	7.90	220	6.4	8	0.2
5.	Jatharpeth (Hand pump water)	---	---	31.3	7.03	962	2.8	10	0.1



a b

c d

Graph-1: **a**. pH of the water samples from different sampling points (n=5); **b.** TDS values of the water samples from different sampling points (n=5). **c.** Dissolved Oxygen (DO) content of the water samples from different sampling points (n=5); **d**.Dissolved Carbon dioxide (DCO_2) content of the water samples from different sampling points (n=5).

Conclusion and Recommendations

Water is the most precious gift of mother nature. This study shows that ground water is the major source for people in the study area. The pH value of collected water samples varied between 6.71 to 7.9. TDS value of Bore well water and tap water from Akola Municipal Corporation is within limit, but it is very high in hand pump water. Dissolved oxygen content was found satisfactory in all water sources except hand pump water. Dissolved carbon dioxide and residual chlorine contents are permissible in every drinking water source of study area. Overall, the water quality in the investigated area is found to be safe for drinking and domestic use. The season wise variation always occurs in water quality. To control the variation, regular monitoring is essential. For user of hand pump water, the best way to get safe drinking water is by installing a water purifier.

References

- **Arya, S., Yadav, A., Chauhan, D.S. and Zaidi, J. (2014).** Physico-chemical analysis of Groundwater collected from Moth Block of Jhansi District, U.P., India. *International Journal of Development Research.* 4 (11): 2172-2174.
- **Deshmukh S.S. and Suradkar S.W. (2022).** Physico Chemical Analysis of Groundwater Samples from Patur, District Akola (MS). *IJCRT.* 10 (2): 453-457.
- **Firmal S. (2009).** A Study on the Water Quality of NIT Rourkela. *B.Tech. Project.*
- **Ibanez, J.G., Esparza, M.H., Carmen, D-S. and Singh, M.M. (2008).** Dissolved Oxygen in Water. In book: *Environmental Chemistry.* DOI: 10.1007/978-0-387-49493-7_2
- **IS 10500 (2012).** Indian Standard - drinking water specification, 2nd revision.
- **Milburn, T.R. and Beadle, L.C. (1960).** The Determination of Total Carbon Dioxide in Water. *J Exp Biol.*, 37 (3): 444–460.
- https://doi.org/10.1242/jeb.37.3.444
- **Ramesh kumar, G.B. and Hemanth, G.T. (2018).** Analysis of water quality -A review *International Journal of Pure and Applied Mathematics.* 119 (17): 2903-2909.
- **Saleem Mohd., Ahmed Muqeem., Mahmood Gauhar and Rizvi S.A.M. (2012).** Analysis of Groundwater Quality Improvement Using Rainwater Harvesting: A Case Study of Jamia Millia Islamia. *International Journal of Modern Engineering Research (IJMER),* 2(5): 3912- 3916.
- **Sasikaran, S., Sritharan, K., Balakumar, S., Arasaratnam, V. (2012).** Physical, chemical and microbial analysis of bottled drinking water. *J Ceylon Medical.* 57(3):111–116.
- **Shrivastava, S. (2014).** Water Quality Analysis of Water Bodies of Kantajhar Basti. *B.Tech Project Report.*
- **Siddiqui, A., Kulkarni, D., Sohoni, V.S. and Thorat, S.S (2018)**. Analysis of Groundwater Quality in Pune City, *International Journal of Civil Engineering and Technology*, 9(6): 1088–1095.
- **World Health Organization (2022).** Guidelines for drinking-water quality: fourth edition