Physicochemical Studies on Assessment of GroundWater near Bendri in Raipur City,Chhattisgarh, India

Laxmipriya[1], Dr. Shilpi Shrivastava[2]

[1]MSc Chemistry IV Sem, Department of Chemistry, Kalinga University, Raipur 492101(C.G.)

[2]Professor & Head, Department of Chemistry, Kalinga University, Naya Raipur 492101(C.G.).

Email:shilpi.srivastava@kalingauniversity.ac.in

Abstract:

Water is a highly important component for all organisms. It keeps the city's water table, temperature, drinking water supply, domestic needs, and irrigation needs. The purpose of the current water testing is to assess the quality of several water sources in Raipur, the state capital of Chhattisgarh. Physico-chemical properties of water samples, including turbidity, pH, total alkalinity, chloride, total hardness, total dissolved solid, dissolved oxygen, and total coliform, were tested and analysed. The most polluted of these nine ponds is. Since none of these water sources are fit for drinking or domestic use, adequate treatment is required before they may be used in the home. The water in Bendri Pond is the consequence of the current work.

Keywords: Water quality testing, drinking water standard, Pollutant, Pond water.

1. Introduction

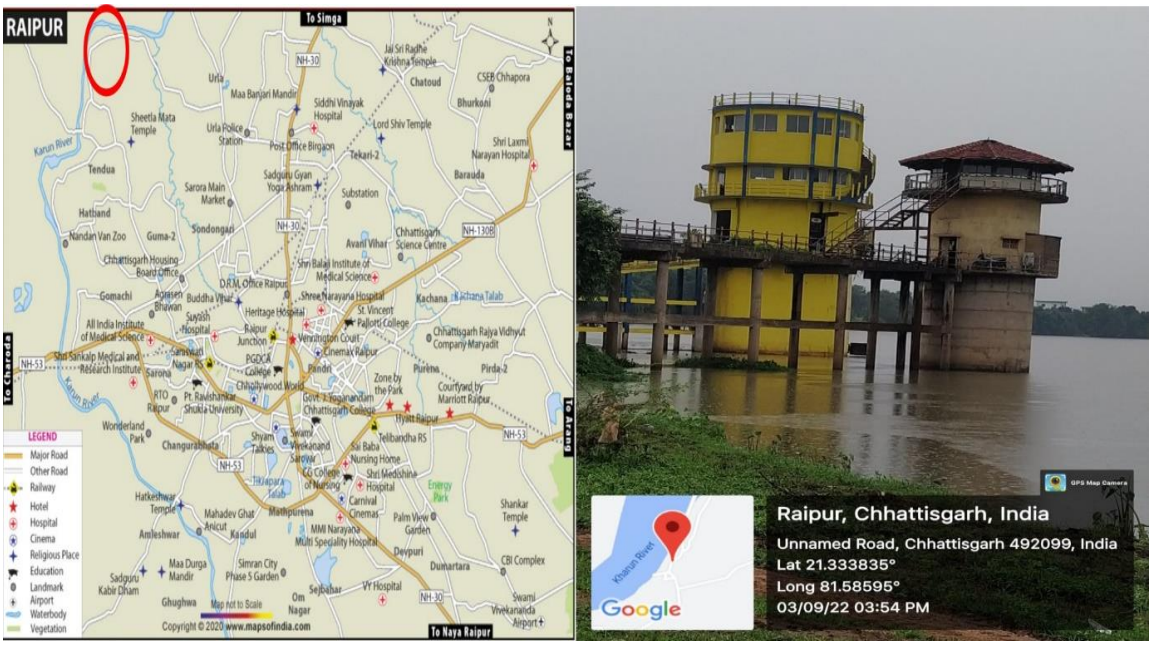
The location code or village code for Bendri village is 444751, as per data from the 2011 Census. The village of Bendri is situated in Chhattisgarh, India's Raipur district, in the Raipur tehsil. The location of Bendri Village's district and sub-district headquarters is 20 kilometres from Raipur. According to data from 2009, Bendri village also has a gramme panchayat. The seasons have previously had an erratic rhythm due to climate change. Extreme weather events in recent years are well-known, and they have contributed to a greater scarcity of water and energy supplies (Grant et al., 2012 and Vorosmarty et al., 2010). Chhattisgarh, like other regions of India, relies heavily on monsoon rainfall to meet its water needs. Reservoirs and other resources were therefore constructed following independence. However, Chhattisgarh has long been renowned for its pond, popularly known as Talab, which has played a significant role in the state's history. The capital city, "Raipur," is surrounded by a number of ponds. number of nullahs that release domestic sewage and industrial waste into the Kharun river without treatment. For than 40 years, the river has provided for the needs of Raipur city. Due to untreated sewage and industrial effluents entering the river during the past ten or so years, the quality has declined. The water quality has now gotten so bad that it is unfit for drinking, let alone bathing.

Ponds are more vulnerable to contamination than moving rivers since they have stationary water bodies. These ponds are contaminated by a number of different sources. If the water is

used for home supply, any contamination has an impact on both human health and the flora and fauna. One of a person's essential needs for survival is access to fresh water. Most fresh water bodies worldwide are being contaminated, which reduces the mobility of water (Gupta S,2008). Ponds are crucial for ecology and play a significant role in a variety of habitats, including I habitat for wildlife (ii), rainwater collection (iii), surface and ground water recharging (iv), flood management (v), and food and nutrition for numerous creatures, among others. However, the discharge of waste water from residential areas, sewage outlets, solid wastes, detergents, automotive oil wastes, fishing facilities, and agricultural pesticides from farm lands are the main causes of pond, lake, and river water pollution (Bhuiyan JR, 2007). Domestic effluents have increased due to large-scale urban growth brought on by population growth or rural-to-urban migration, while industrial development resulted from the establishment of new industries or the expansion of existing industrial establishments, producing large volumes of industrial effluents (Verma AK,2010). In the current effort, the water quality of significant ponds around Raipur's city limits was assessed.

Geographic Location

The Bendri of Raipur, the Indian state of Chhattisgarh's capital, are the subject of the current study. The state of Chhattisgarh's Raipur city is located in the lush plains of the Mahanadi River basin. Since a few years ago, pond water has had an algal bloom. In addition to an increase in substandard sanitation, pond swallowing has been an issue in recent years.



2. Materials and Methods

2.1 Methodology and sample collection

In the month of January 2022, following the monsoon season, water samples from nine ponds were collected in plastic bottles and designated as samples 1 (Table 1). All parameters were calculated using the APHA-recommended methodology. Each sample's analysis result was compared to a standard set by the World Health Organization (WHO). Each of the ponds listed in Table 1 had water samples taken from them for physical and chemical analysis. The findings of an analysis for a number of water quality indicators, including pH, dissolved oxygen (DO), and phosphorus content, are shown in Table 1. Standard techniques were employed for sampling, preservation, transportation, and analysis (American Public Health Association 1995). In every experiment, the standard was made from freshly prepared distilled water. A pH metre was used to determine the samples' pH. A digital turbidity metre was used to measure turbidity. By using the titrimetric approach, total alkalinity, acidity, and hardness were determined. Winkler's method and the closed refluxed method were used to measure the dissolved oxygen (DO) and chemical oxygen demand (COD), respectively. Phosphorus and total nitrogen were measured by spectrophotometer [Double Beam] and Total Kjeldahl Nitrogen method, respectively.

3. Results and Discussion

3.1 pH measurement

A pH metre was used to measure the pH. The pH ranged from 7.6 to 9.36 during the month of October. Water with a pH below 6.5 corrodes pipes, releasing poisonous metals as Zn, Pb, Cd, and other such as. (Trivedi, R.K,2006).

3.2 Turbidity

Turbidity is the term for the suspension of particles in water that prevent light from passing through (Hemlata Mahobe, 2013). The range of turbidity ranges from 3.1 to 30.2. According to the visual analysis, green moss was the cause of the greater turbidity that was seen. The concentration is high, which might be caused by particles being added directly to the pond from runoff water, sewage, municipal effluents, and other home effluents (Jain S.M,1996).

3.3 Alkalinity

Alkalinity, which ranges from 200 to 668 mg/l, is a measurement of how well water can neutralise acids. Large amounts of alkalinity give water a harsh taste (Howard S.Peavy).

3.4 Acidity

Acidity is varies between 4 to14 and almost nil in water.

3.5 Dissolved Oxygen (DO)

The most crucial factor is the concentration of dissolved oxygen. There is a decrease in the types of life that may survive as DO falls below 4 to 5 mg/l (Gilbert M.). The sample's DO

level is between 3.1 and 3.2. Low DO values have been linked to the decomposition of organic materials, which demands oxygen, in order to occur. (Hemlata Mahobe,2013).

3.6 Total Solids

The type of the bed rocks and soil that formed from them determines the majority of the solids present in a natural body of water (Nighojkar Abhineet,2014). Solids are increasing as a result of the organic materials in the water body decomposing. The sample ranges from 230 to 1840 mg/l.

3.7 Total Hardness

The quantity of multivalent metallic cations in solution is used to define hardness (Howard S.Peavy). It varies in the current study from 111 to 176 mg/l.

3.8 Chloride

The presence of a lot of organic waste with an animal origin is thought to be a sign of pollution given the high concentration of chloride (Trivedi P,2009). Chloride is nearly absent in the range of7.9 to 49.9 mg/l.

3.9 Biological Oxygen Demand (BOD)

The Biochemical Oxygen Demand (BOD) is the volume of oxygen used by microbes when they break down organic materials (Howard S.Peavy). BOD is a measure of microbial activity and the presence of dead organic matter that microorganisms can eat. The BOD value and dissolve oxygen content were found to be inversely related. (Coscun.I.1989).

3.10 Chemical Oxygen Demand (COD)

The COD test identified the chemical oxygen needed for organic matter. The levels in the samples ranged from 0.3 to 1.55 mg/l.

3.11 Phosphorus content

In freshwater, phosphorus (P) is typically regarded as the limiting nutrient for plant growth, with modest amounts naturally arising primarily from geological sources. The most common type of phosphorus in natural waters and wastewaters is phosphates. The aquatic food web's plants and animals depend on phosphorus as a vital nutrient. Although phosphorus is a necessary component for plant life, excessive amounts in water speed up problems like eutrophication. (Sumant Kumar, 2015

3.12 Total Nitrogen

This is a measurement of all nitrogen species (organic and inorganic). The proportional proportions of the many types of nitrogen, such as ammonia, nitrite, nitrate, or organic nitrogen, present determine the relevance of nitrogen in the aquatic environment. Normal nitrate levels in groundwater and surface water are modest, but they can rise when there is agricultural runoff, refuge dump runoff, or pollution from human or animal waste (Nas, B, 2006). The sample ranges from 0.4 to 5.1 mg/l.

Table-1: Physical and chemical properties of water collected from Bendri pond in Raipur city.

S. No.	Characteristics	Test Method (IS 3025)		Units of measurement			
		Method	Part no.		Acceptable limit	Maximum Permissible Limit	01
1	Colour	IS-3025	Part 04	cfu	Agreeable	Agreeable	Disagreeable
2	Odour	IS-3025	Part 05		Agreeable	Agreeable	Agreebale
3	Taste	IS- 3025	Part 07 & 08		Agreeable	Agreeable	Disagreeable
4	pH@25℃	IS 3025	Part 11	pH scale	6.5-8.5	6.5-8.5	7.34
5	Conductivity@25℃	IS 3025	Part 14	µS	-	-	266.5
6	Total Hardness	IS 3025	Part 21	mg/L	200	600	120.4
7	TDS	IS 3025	Part 16	mg/L	500	2000	121.9
8	Turbidity	IS 3025	Part 10	NTU	1	5	21
9	Calcium as Ca^{2+}	IS 3025	Part 40	mg/L	75	200	83.85
10	Magnesium as Mg^{2+}	IS 3025	Part 46	mg/L	30	100	36.55
11	Alkalinity	IS 3025	Part 23	mg/L	200	600	60.3
12	Chloride	IS 3025	Part 32	mg/L	250	1000	17.86
13	E.Coli	IS 3025		Number/	Absent	Absent	Present
14	Iron	IS 3025	Part 53	mg/L	0.30	0.30	0.1621
15	Nitrate-N	IS- 3025	Part 34	mg/L	45	45	496.93
16	DO	IS- 3025	Part 38	mg/l	2	6	8.2
17	BOD	IS-3025	Part 44	mg/l	30	100	5.2
18	COD	IS- 3025	Part 58	mg/l	-	-	24
19	Fluoride	IS- 3025		mg/l	1	1.5	3.2
20	Sodium	IS- 3025		mg/l	200	-	11.81
21	Potassium	IS- 3025		mg/l	-	-	18.42
22	Residual chlorine	IS- 3025		ppm	-	-	0.2
23	TSS	IS- 3025		mg/L	-	-	12
24	Sulphate	IS- 3025		mg/l	400		168

4. Conclusions

Rapid urban expansion is contributing to an increase in the water quality issues. According to the water quality measurements conducted for this study, water source near Bendri area in Raipur is highly polluted and good for drinking purpose. By stopping the industrial water flow, sewage water flow and disposing of pet and animal waste properly, the quality of the water may be improved. The biological decomposition of dissolved organic matter to occur under aerobic conditions is directly impacted by the BOD level, which is relatively low in comparison to the standard. Water sample was contaminated by E. coli bacteria, which is harmful for both human and animal health.

References

[1] S.B. Grant, J. Saphores, D.L. Feldman, A.J. Hamilton, T.D. Fletcher, P.L.M. Cook, M. Stewardson, B.F. Sanders, L.A. Levin, R.F. Ambrose, A. Deletic, R. Brown, S.C. Jiang, D. Rosso, W.J. Cooper, I. Marusic "Taking the "waste" out of "Wastewater" for human water security and ecosystem sustainability" Science, 337 (6095) (2012), pp. 681–686

[2] C.J. Vorosmarty, P.B. McIntyre, M.O. Gessner, D. Dudgeon, A. Prusevich, P. Green, S. Glidden, S.E. Bunn, C.A. Sullivan, C.R. Liermann, P.M. Davies Global threats to human water security and riverbiodiversity, Nature, 467 (7315) (2010), pp. 555–561.

[3] Bhuiyan JR, Gupta S. A comparative hydro biological study of a few ponds of Barak Valley, Assam and their Role as sustainable water resources. J Environ Biol. 2007;28(4):799-802)

[4] K. Coscun.I.,Yurteri,s.,Mirat.T.and Gurol,D., (1989). Removal of dissolved organic concentration by ozonation, Env. Progress, 6(4), 240-244.

[5] Gilbert M. masters Introduction to Environmental Engineering And Science ,Prentice Hall of India Private Limited, New Delhi

[6] APHA, Standard methods for the examination of water and wastewater. American Public Health association (19th ed.1995), Washington DC, 2003

[7] Gupta S, Maheto A, Roy P, Datta JK, Saha RN (2008) Geochemistry of groundwaterBurdwan district, West Bengal India. Environ Geol 53:1271–1282.

[8] Hemlata Mahobe , Study of Physico-Chemical Characteristics of Water Ponds of Rajnandgaon Town, Chhattisgarh, International Journal of Scientific & Engineering Research, Volume 4, Issue 8, August-2013 738 , ISSN 2229-5518

[9] Howard S.Peavy ,Donald R. Rowe, Environmental Engineering ,McGro-Hill International Edition

[10] Jain S.M., Sharma M. and Thakur R. (1996). Seasonal variation in physico-chemical parameters of Halai reservoir of Vidisha district India. Indian J. Ecobiol., Vol. 8(3), 81-188

[11] Nas, B., & Berktay, A. (2006) Groundwater contamination by nitrates in the city of Konya, (Turkey): A GIS perspective. Journal of Environmental Management, 79, 30–37

[12] Nighojkar Abhineet And Er.D.Dohare ,Physico- Chemical Parameter for Testing of Present Water Quality of Khan River at Indore, India International research journal of Env.Sci. ISSN 2319-1414 Vol.3(4),74-81, April (2014)

[13] S. Venkateswaran, M. Elangomannan, M. Suresh, Prabhu MV. Evaluation of Physico-Chemical Characteristics in Groundwater Using GIS –A case.