



ISSN: 2350-0328

**International Journal of Advanced Research in Science,  
Engineering and Technology**

**Vol. 3, Issue 1 , January 2016**

# **Assessment of Ground and Pond Water Quality of Rajnandgaon City, Chhattisgarh, India**

**Sonam Shukla, D. K. Pandey, D. K. Mishra**

Department of civil engineering, Manoharbai Patel Institute of Engineering & Technology, Gondia,  
Maharashtra, India.

**ABSTRACT:** This paper deals with the systematic study on the Physio-chemical characteristics of Ground water as well as Pond water in Rajnandgaon City of Chhattisgarh State. The study has been carried out to ascertain the suitability of the water for domestic purposes. Water samples from major Ponds & major residential areas were collected during post-monsoon season for a physiochemical analysis. The samples collected were analyzed for the parameters like Color, pH, Temperature, Turbidity, EC, TDS, total hardness, total alkalinity, chlorine, calcium hardness and magnesium hardness. Comparative studies of samples in different area were carried out and the results were compared with WHO, BIS & ICMR drinking water standards. The study of physico-chemical characteristics of water samples suggests that the evaluation of water quality parameters as well as water quality management practices should be carried out periodically to protect the water resources. The parameters like turbidity, alkalinity and total hardness contents in some samples of surface water are alarming. The EC of almost all samples are beyond the acceptable limits and EC of Ground water samples are reaching near maximum allowable limits of WHO, BIS and ICMR. The TDS levels in Pond Water Samples are above the acceptable limits. Total hardness and TDS in the ground water samples shows very wide variations and some samples have crossed the maximum permissible limit of WHO and ICMR.

**KEYWORDS:** Pond water, TDS, World Health Organization (WHO), Bureau of Indian Standards (BIS), Ground water, and Electric Conductivity (EC).

## **I. INTRODUCTION**

Water is prime natural resource a basic human need and a precious natural a set. Fresh water resources are used for various purposes, like agricultural, household, recreational, environmental activities. Water is the most vital resources for all kinds of life on the earth and essential for the sustainability of the earth's ecosystem. Groundwater is used for domestic, industrial, water supply and irrigation all over the world <sup>[8][17][18]</sup>. Construction of ponds is also considered to be the solution to water problem. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization <sup>[14]</sup>. Human health is threatened by unsanitary conditions through open drain carrying and disposing wastewater into natural water bodies. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas <sup>[3][5]</sup>. Rajnandgaon a primary town of Rajnandgaon district located in the western part Chhattisgarh state of India. It is located at 21.10°N and 81.03°E in Chhattisgarh. It has an average elevation of 307 metres (1010 feet) and its total population is 163122(as per 2011). this paper provides an overview of freshwater issues in Rajnandgaon city. In this study water samples from major Ponds & major residential areas were collected for a physiochemical analysis to establish the quality of the water.

## **II. METERIALS AND METHODS**

### **A. STUDY AREA:**

Study area involves the major ponds and major residential areas in the Rajnandgaon city. The pond water are collected from the Places like Ranisagar, Budhasagar, Chikhli talab, Bada talab and Moti talab. The ground water samples are collected from the area which are densely populated like Basantpur, Srishti colony, New Civil Lines, Gauri nagar and

Kailash nagar. The sites can be seen in Fig 1. (Red circles represent the ground water sampling points & blue circles represent the pond water sampling points). All the sampling points are at least 1-2 Km away from one another.

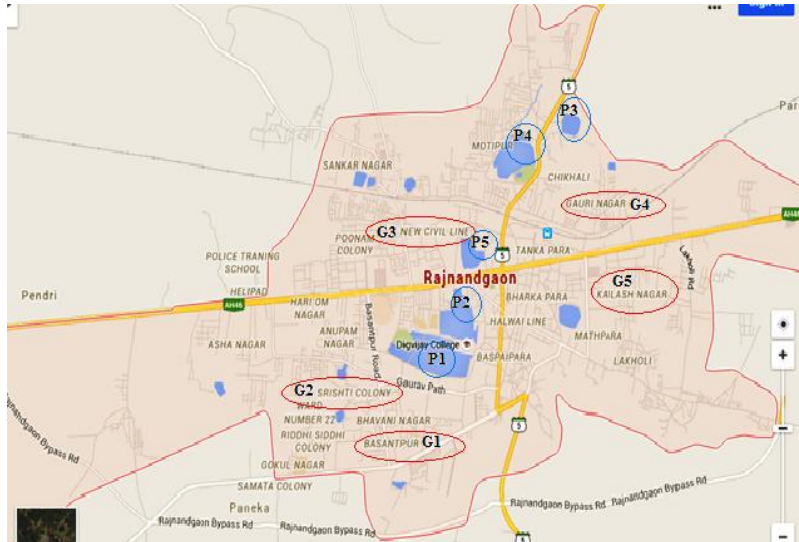


Fig. 1: Rajnandgaon City map showing sampling points.

**B. SAMPLE COLLECTION:**

In total 10 samples have been collected for the study. Out of which 5 samples are of pond water (i.e. surface water) & 5 samples are of Ground water. Samples were collected through Grab sampling process. Plastic collection bottles of 1000ml capacity were used for collection of samples [13][15]. The collected samples were kept under normal room temperature during the testing procedure [2][6][9]. Table 1 will help us to understand the sample locations.

Table 1: Sample Collection Sites.

Sample	Pond Water Sites	Sample	Ground Water Sited
P <sub>1</sub>	Ranisagar	G <sub>1</sub>	Basantpur
P <sub>2</sub>	BudhaSagar	G <sub>2</sub>	Srishti Colony
P <sub>3</sub>	Chikhli Talab	G <sub>3</sub>	New Civil Line
P <sub>4</sub>	Bada Talab	G <sub>4</sub>	Gauri Nagar
P <sub>5</sub>	Moti Talab	G <sub>5</sub>	Kailash Nagar

**C. METHODOLOGY:**

The analysis of water quality is carried out as per APHA norms to establish the existing water quality. The existing water quality is then compared with the water quality standards presented by the Central Pollution Control Board, New Delhi, APHE, WHO & BIS (IS:10500-2012) [4][7][11]. The parameters like pH and Temperature are recorded on the spot. Other parameters like EC, TDS, Salt, Alkanity, Hardness, Ca++, Mg++, Cl- recorded in the laboratory by Standard methods [1][2][10].

**III.RESULTS AND DISCUSSIONS:**

**A. Pond water Samples:**

*pH* in these samples varies from 7 – 7.8 this shows that all samples are within the minimum and maximum tolerable limits. All the samples were found to be slightly basic in nature. *Color* of the samples in pond water is slightly grey in appearance which shows that the water is contaminated by the pollutants. Pond water samples are highly turbid in nature & is of low quality. Sample P<sub>1</sub>, P<sub>2</sub> and P<sub>4</sub> cross the maximum allowable limits. *Turbidity* is the key test for water quality [6][19]. *TDS* in all the samples have crossed the allowable limit of 500 mg/l. the higher values of total dissolved solids is attributed to application of fertilizers. Water containing high solids may cause laxative or constipation effects. Except P<sub>3</sub> all pond water samples have alarming values of *Total hardness* which is above 200mg/l [6][19]. Alkalinity of the pond water samples are almost within the limit except in sample P<sub>2</sub>. *Conductivity* of sample P<sub>1</sub> and P<sub>4</sub> are slightly high but are under the maximum allowable limits from WHO. The *Ca<sup>++</sup> hardness* of all the water samples are above the acceptable limits i.e. 75 mg/l which is not recommended for drinking purposes and the *Mg<sup>++</sup> hardness* are within the allowable limit i.e. 30 mg/l. The amount of *chlorine* in pond water samples is quite high as compared to that of ground water samples.

**B. Ground Water Samples:**

*Color* of the samples in ground water is clear in appearance. *pH* in these samples are within the minimum and maximum tolerable limits. All the samples were found to be slightly basic in nature. Ground water samples are not turbid in nature and the *turbidity* values are below 1 N.T.U. *TDS* in all the samples have crossed the allowable limit of 500 mg/l [6][17], water with high solid concentrations affects persons who are suffering from kidney and heart diseases. G<sub>1</sub>, G<sub>2</sub> and G<sub>4</sub> samples shows higher values of *Total hardness*. *Conductivity* of G<sub>2</sub>, G<sub>3</sub> and G<sub>5</sub> sample higher than 1500 μS/cm which is higher than tolerance limit.. Both *Ca<sup>++</sup> & Mg<sup>++</sup> hardness* of all the water samples are above the acceptable limits i.e. 75 mg/l and 30 mg/l/ respectively. which is not recommended for drinking purposes. The general water quality in the samples from different sampling places is listed in Table 2.

**IV. CONCLUSION**

The above study suggests that out of 10 samples collected from different sites of the city, the pond water samples are highly contaminated. Almost all the parameters under which the pond water samples are tested are exceeding the allowable limits recommended by BIS, WHO etc. It is clear from the above findings that the surface (pond) water in the city is unfit for the domestic use and needs high amount of purification before use. Whereas the ground water samples are less contaminated as compare to that of pond water. But still, ground water also needs to undergo certain primary purification for further use and can even be used for drinking purposes but not for longer period of time.

Table 2: Analysis Results of the Physiochemical Properties of the Collected Water Samples

Sample Nos	Unit of Measure-	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>	G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>
Parameters	ment										
pH	PH Scale	7.23	7.54	7.19	7.64	7.5	7.56	7.33	7.12	7.35	7.35
Color	-	grey	grey	Slight Clear	Slight Grey	Slight Clear	clear	clear	clear	clear	clear
Temperature	°C	27	27	26.3	25	26	23	24	23	23	24
Turbidity	N.T.U.	5.1	5.5	3.8	4.0	3.1	0.03	0.47	0.89	0.23	0.08
Conductivity	μS/cm	571	466	445	651	405	1306	2280	1538	1383	2350



ISSN: 2350-0328

# International Journal of Advanced Research in Science, Engineering and Technology

Vol. 3, Issue 1 , January 2016

Total Hardness	Mg/l	416	352	188	294	238	298	360	186	332	143
Alkalinity	Mg/l	244	292	196	224	194	234	216	211	217	226
Ca <sup>++</sup>	Mg/l	89	134	95	81	68	182	154	176	185	116
Mg <sup>++</sup>	Mg/l	13.8	24.6	18	20.8	21	32.3	41.8	29.4	46.1	26.9
TDS	Mg/l	871	737	672	824	754	656	1150	270	448	679
Cl <sup>-</sup>	Mg/l	106	125	91	150	113	40	19	14	37	47

## REFERENCES

- [1] Ahirakwem Cosmas Ahamefula and Onyekuru Samuel O. "A Comparative Assessment Of The Physico-Chemical And Microbial Trends In Njaba River, Niger Delta Basin, Southeastern Nigeria" , Journal of Water Resource and Protection, 2011, 3, 686-693n doi:10.4236/jwarp.2011.39079 september 2011 <http://www.scirp.org/journal/jwarp>
- [2] APHA, Standard Methods for Examination of Water and Wastewater, 16th Ed., American Public Health Association, Washington, DC. c1985, 197-1157.
- [3] Arya Sandeep, Devi Archana and Kumar Vinit, "A Comparative Study Of Water Quality Assessment Of Parichha And Sukma Dukma Dam, Jhansi, India", International Journal of Advanced Engineering Technology E-ISSN 0976-3945, iv/iv/oct-dec.,2013/45-50
- [4] Belorkar Seema A. "Assessment of the Deterioration in Physiochemical and Microbiological Quality of Shivnath River Water in Durg District, India" E-Journal of Chemistry ISSN: 0973-4945;
- [5] Bhadja Poonam and Vaghela Ashokkumar, "Assessment Of Physico-Chemical parameters And Water Quality Index of Reservoir Water" International Journal of Plant, Animal and Environmental Sciences, Vol 3 july- sep 2013, ISSN 2231-4490
- [6] BIS (IS: 10500-2012) Drinking Water Specification.
- [7] CPCB (2009), Central Pollution Control Board, New Delhi.
- [8] Dohare Devendra et. at. "Analysis of Ground Water Quality Parameters: A Review", Research Journal of Engineering Sciences, Vol. 3(5), 26-31, May (2014), ISSN 2278 – 9472
- [9] Garg S K , Water supply engineering, khanna publishers oct 2010.
- [10] Kumar Mahesh Akkaraboyina and B.S.N.Raju "A Comparative Study Of Water Quality Indices Of River Godavari", International Journal of Engineering Research and Development eissn : 2278-067x, pissn : 2278-800x, www.ijerd.com volume 2, issue 3 (july 2012), pp. 29-34
- [11] Pandey Devendra "Surface Water Quality with Painstaking Human Impacts-A Case Study of the Wainganga River, Bhandara, Maharashtra, India" International Journal of Bioassays (IJB) 272, ISSN: 2278-778X.
- [12] Pandey et. al. "Water Quality Assessment of Bhandara and Gondia Districts of Maharashtra State, INDIA" International Journal of Research in Chemistry and Environment Vol. 1 Issue 1 July 2011(114-118) ISSN 2248-9649.
- [13] Rennie Matthew J. "A Water Quality Survey of the River Ouseburn", MEng Civil Engineering , School of Civil Engineering & Geosciences, Newcastle University 2012.
- [14] Shivaprasad , Nagarajappa, Sham Sundar K , "A Study on Physico-Chemical Characteristics of Borewell Water In Sugar Town, Mandya City, Karnataka State, India" Shivaprasad H et al Int. Journal of Engineering Research and Applications, Vol. 4, Issue 7( Version 1), July 2014, pp.112-123 ISSN : 2248-9622.
- [15] Shukla Sonam et. al. "Water Quality Assesment of Physiochemical Properties of Shivnath River in Durg District (Chhattisgarh)", International Journal of Research in Advent Technology, Vol.3, No.12, December 2015 E-ISSN: 2321-9637 Available online at [www.ijrat.org](http://www.ijrat.org)
- [16] Singh Ajit Pratap and Shrivastava Parnika, "A Comparative Study on Water Quality Assessment of A River Using AHP and Promethee Techniques", Hydraulics, Water Resources, Coastal and Environmental Engineering (HYDRO 2014)
- [17] T.suresh and N. M. Kottureshwara "Assessment of Groundwater Quality of Borewells Water of Hospet Taluka Region, Karnataka, India" Rayasan J. Chem. rjcabb, vol.2, no.1 (2009), 221-233 issn: 0974-1496 coden <http://www.rasayanjournal.com>
- [18] Upadhyay Manish and Mishra Anisha "Study o f Physico-Chemical Properties of Surface Water (Shivnath River & Ponds) In Durg and Rajnandgaon Region" Acta Biomedica Scientia. 2014;1(1):14-17.
- [19] WHO (1972). World Health Organization