

Monitoring the quality of drinking water in various district of Chhattisgarh

Sheshkumari Sahu and Manoj Kumar Ghosh *

School of Chemical Sciences, Bharti Vishwavidyalaya, Durg, Chhattisgarh, India.

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Abstract

In this paper we are monitor the assessment of quality of groundwater is crucial role for the suitability of drinking purpose, health issues and other various purposes such as bathing, washing cloths, domestic uses and for agriculture. For this purpose we are collect the sample from different district of Chhattisgarh from Jan 2023 to June 2023. A water quality index is applied to monitor and summarize the overall quality of groundwater based on various water quality parameter in ten different district of chhattisgarh. Analytical parameters like alkalinity, pH, EC, TDS, HS, Ca, Mg, fluoride, Cl, arsenic, toxic elements, DO, BOD, COD, sulphate, NO₃ are commonly monitored in the ten different district of chhattisgarh such as durg, raipur, bemetara, korba, raigarh, rajnandgaon, balod, korea, dhantari and mahasamund by using ICMR and BIS standard. The analysis of report shown water is not very suitable for drinking but it is useful only for house hold work, bathing and agriculture etc.

Keywords: Ground water quality; Biochemical oxygen demand; Chemical oxygen demand; Indian Council of Medical Research; Bureau of Indian Standards

1 Introduction

Groundwater is a vital resource for drinking, irrigation, and industrial purposes in Chhattisgarh, India[1-5]. The quality of ground water is directly impacts on human health, agriculture, and the overall environment[6-8]. According to WHO consuming contaminated water is the foundation motive of 80 percent of diseases suffered by human population in the growing international countries[9-14]. Contamination of ground water is developed due to both natural and anthropogenic sources due to which peoples are suffering from several disease such as hepatitis, thyroid, diarrhoea, dengue, malaria, fluorosis, dysentery, cancer, gastro intestinal, intestinal infection and liver problem etc[15]. The WQI is an important tool of for assessing and monitoring the quality of water in various context, such as drinking water, recreational water bodies and aquatic ecosystem[16]. The Water Quality Index provides a comprehensive assessment of water quality, serving as a vital tool for protecting human health, maintaining ecosystem integrity and promoting sustainable water resource management[17-18]. The quality of ground water influenced by several factors, including the geological and hydrological properties of the area, land use practices, proximity to potential pollution sources and the natural process of filtration and purification as water move through surface[19]. Generally speaking, a water quality index is measured by combining data on different water quality parameters into a mathematical equation and assigning a number to each different water quality parameter. Calculation of water quality included physical chemical and biological characteristics of water[20].

1.1 Study Areas

The collection of sampling area is situated in the central india and it is Chhattisgarh (as shown in Figure1), at longitude 80°15' to 84°20' east and latitude 17°46' to 24°5' north. Durg district is situated at 21.12° north latitude, 81.20° east longitude and 290 meter above sea level. Raipur district is situated in between of 21.25° latitude, 81.62° longitude is on

*Corresponding author: Manoj Kumar Ghosh

the mainline of Howrah-Mumbai Railway track. The Balod district is located near Durg district at 20.73° North and 81.20° East. Bemetara is located between 21°42' 50.49" north latitude and 81°32' 8.21" east longitude. Korba district is located at 22.36° latitudes and 82.73° longitude. The latitude of the Raigarh district is on 21.89° latitudes and the longitude is 83.39°. Rajnandgaon district is situated at 21°06' N and 81°02' E. Korea district is lies between latitudes 22°56' to 23°48' north and longitudes 81°56' to 82°47' east. The latitude of Dhamtari, district latitudes is 20.70° and longitude is 81.55°. Mahasamund is situated at 21.1°N and 82.1°E as so on.



Figure 1 GPS Locations of various district of chhattisgarh

2 Material and Methods

The physicochemical parameter are determined by standard method ,the method of various physicochemical parameter are shown on table 1. The outcomes were compared to drinking water standards set by Indian council of medical research, Bureau of Indian standards and World Health Organization.

Table 1 Chemical variable and the method used to measure them

Parameters	Methods
pH	Systronics pH meter
BOD	BOD MerckBOD meter
Alkalinity	Titration
TH	EDTA
TDS	Digital meter
EC	Conductivity Meter
Sodium	Flame photometer
Calcium	”

Magnesium	”
Chloride	Titration
Fluoride	Potentiometric
potassium	Flame photometer
Nitrate	UV Spectroscopy
Sulphate	Turbidity metre
COD	Spectroquanta Merck COD meter
DO	Chemiline DO meter CL-930

2.1 Water Quality Index

The WQI is measure of tools to used , assess and monitor the quality of waterresource based on the several parameters. In order to determine the ground water is suitable for human use or consumption only for domestic purpose. So we need to calculate the WQI.

Table 2 WQI-based classification water quality

Types	WQI	Water Quality Standard
One	Less than 25	Excellent
Two	26-50	Good
Three	51-75	Poor
Fourth	76-100	Very poor
Fifth	More than 100	Not suitable to drink

2.2 Calculation of WQI

The WQI is a numerical expression that provide an overall assessment of water quality index is based on various parameter. It should be computed by using the weighted arithmetic mean approach.

2.2.1 Computation of quality level(q_n):

$$q_n = 100[(V_n - V_i)/(S_n - V_i)]$$

where q_n =quality level of nth parameter
 V_n = Observed value of nth term
 S_n =Standard permissible value of nth term
 V_i = ideal value of nth term

2.2.2 Computation of unit weight (W_n):

$$W_n = k/S_n$$

Where W_n = unit weight for nth term.

2.2.3 Calculation of WQI

$$\sum_{n=1}^n q_n w_n / \sum_{n=1}^n w_n$$

Table 3 Standard value of drinking water

Parameters	S_n	W_n
pH	8.5	0.083
BOD	5	0.100

Alkalinity	120	0.006
TH	299	0.002
TDS	499	0.001
Electrical Conductivity	300	0.002
Sodium	200	0.022
Ca	74	0.009
Mg	29	0.024
Cl	249	0.003
Fluoride	1.5	0.471
potassium	12	0.049
Nitrate	45	0.016
Sulphate	150	0.005
COD	20	0.025
Dissolve Oxygen	5	0.141

Table 4 Variation of the Analytical Parameters

Location	Parameters									
	PH	EC S/m	TDS mg/l	TH mg/l	Alkalinity mg/l	SO ₄ mg/l	Nitrate mg/l	DO mg/l	BOD mg/l	COD mg/l
Balod	7.2	424	208	199	243	-	-	-	-	-
Raipur	7.9	1802	1022	335	236	48	8.2	-	-	-
Durg	8.6	935	789	495	320	65	48	5.65	6.5	10.8
Korba	6.5	-	-	300	-	200	45	-	-	-
Raigarh	6.76	290	345	-	142	14.63	28.13	-	-	-
Rajnandgaon	6.54	771	386	234		30.47	18.84	-	-	-
Bemmetara	7.06	1808	1157	657	183	469	26	-	-	
Dhamtari	7.8	836	546	240	-	28	12	-	-	-
Korea	7.9	-	898	286	179	12	2.3	3.9	-	8.9
Mahasamund	6.98	3656	2195	433	-	43	68	5.1	-	-

3 Result and discussion

Analytical results were obtained from the study area and on testing parameters from different location of Chhattisgarh summarized below in table 4 and 5

- **pH** - The sample of pH was found to fluctuate from 6.5 to 8.5, higher the pH affected the bitter test. Higher the pH indicate that the most of the groundwater of Chhattisgarh is alkaline in nature.
- **Electrical Conductivity** - The presence of soluble and highly conductible salt presence in water sample The higher the value of EC due to presence of higher amount of ions is soluble in water.
- **Total Dissolved Solid** - The high value can be result of runoff from water, sludge or industrial waste.

- **Total Hardness** - TH was found in the sample is below in the permissible limit, except Bemetara water sample
- **Alkalinity** - The alkalinity of most of the water sample above the permissible value.
- **Fluoride** - F concentration is below the permissible limit except sample from Dhamtari District.
- **Sulphate** - High sulfate concentration in Bemetara groundwater sample.
- **Nitrate** - Concentration of nitrate is higher in Bemtara and lower in Korea District.
- **Calcium and Magnesium** - The concentration of Ca ,Mg is above the permissible limit , most of the water sample
- **Sodium** -The concentration of sodium above the permissible limit in ground water of Bemetara district.
- **Chloride** - the concentration of Chloride higher in Bemetara district of Chhattisgarh

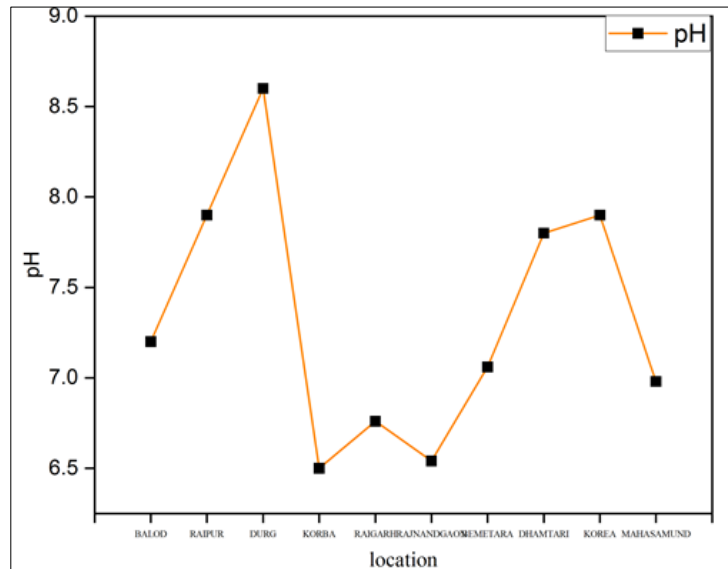


Figure 2 Variation of pH in various districts

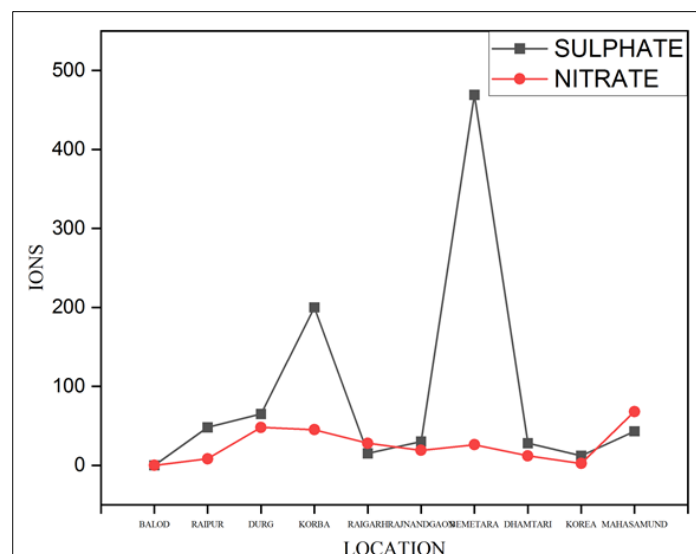


Figure 3 Variation sulphate and nitrate in various districts

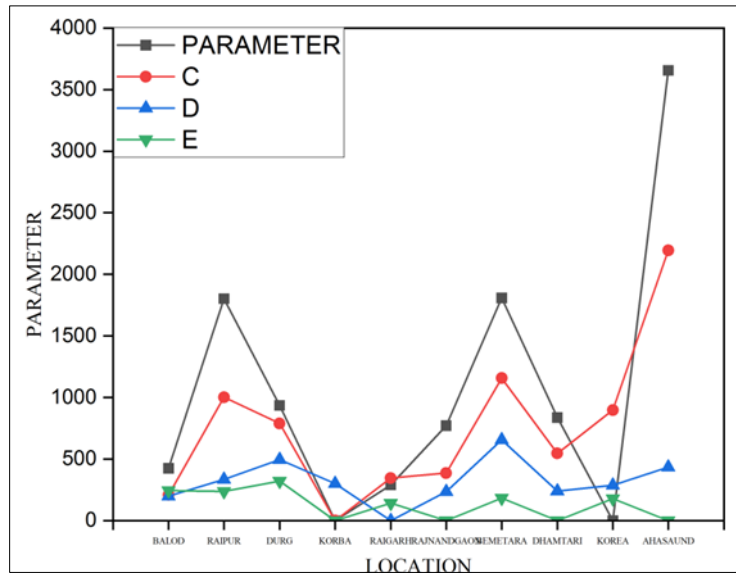


Figure 4 EC, TDS, TH and Alkalinity variation in various districts

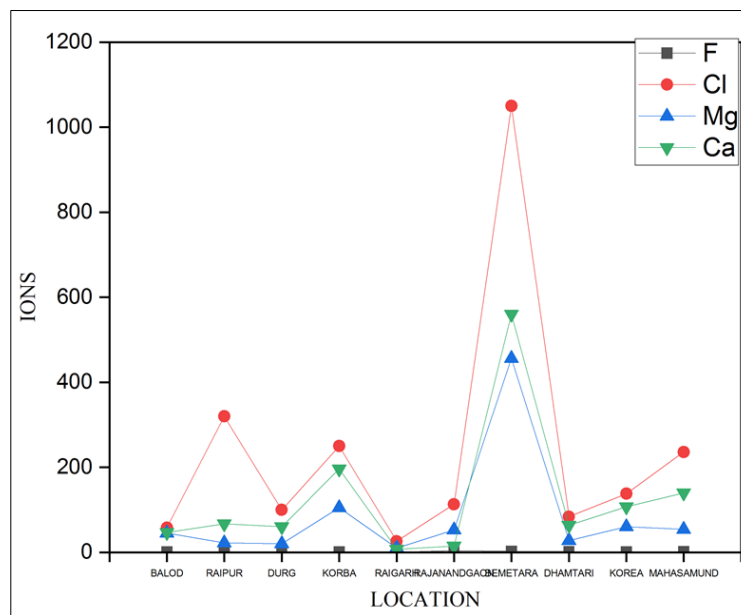


Figure 5 Variation of ions in various districts

4 Conclusion

The main aim of this research paper is to monitor the pollution burden on groundwater in the ten district of chhattisgarh. The water quality is only slightly not upto permissible level than the as per recommended by the standards for drinking purpose, greater values the recommended indicate extremely poor quality of water resulting from both anthropogenic and geogenic source. analytical parameters variation of ground water due to seasonal changes. Some parameters are not suitable for drinking purpose. The state government should make a clear policies and procedure for managing ground water and removal of high parameters as per WHO, BIS and ICMAR. Treatment of ground water is needed because everyone deserve to drinking pure water and free from health hazard.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

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