

Analysis of water quality using physico-chemical parameters in Charcha colliery, Korea district, Chhattisgarh, India

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Abstract

This study was aimed to estimate current status of physico-chemical characteristic of Charcha colliery, at Korea District, Chhattisgarh. Monthly variation in physico-chemical parameters such as water temperature, pH, turbidity, total dissolved solids, total hardness, chlorides, phosphate, nitrates, dissolved oxygen and biological oxygen demand were analyzed for a April-May month 2012. The results indicated that physico-chemical parameters of the water were within the permissible limits and can be used for domestic, irrigation and pisciculture.

Keywords: Charcha colliery, Physico-chemical parameters, Monthly variation, DO

INTRODUCTION

Water plays an essential role in human life. Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water. Fresh water is one of the most important resources crucial for the survival of all the living beings. It is even more important for the human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement. Human and ecological use of ground water depends upon ambient water quality.

Fresh water has become a scarce commodity due to over exploitation and pollution of water. Increasing population and its necessities have led to the deterioration of surface and sub-surface water. Groundwater is the major source of drinking water in both urban and rural areas. The importance of groundwater for the existence of human society cannot be overemphasized. Besides, it is an important source of water for the agricultural and industrial sector. Till recently it had been considered a dependable source of uncontaminated water. Groundwater crisis is not the result of natural factors. It has been caused by human actions. Much of ill health which affects humanity, especially in the developing countries can be traced to lack of safe and wholesome water supply. The quality of ground water is the resultant of all the processes and reactions that act on the water from the moment it condensed in the atmosphere to the time it is discharged by a well or spring and varies from place to place and with the depth of the water. Groundwater is particularly important as it accounts for about 88% safe drinking water in rural areas, where population is widely dispersed and the infrastructure needed for treatment and transportation of surface water does not exist. Standard desirable limit of water quality

parameters in drinking water prescribed by different agencies is shown in Table 2. In Charcha colliery, coal mine and urbanization have major impact on groundwater environment. In areas of Charcha, there are open and underground coal mine. The effluents from these greatly distress the geochemistry of the soil. The discharged chemicals interact with ground water and alter the pH and other water quality parameters. Hence the areas of Charcha colliery were selected to study the effect of sanitary conditions on ground water quality. The social relevance of the problem has encouraged us in carrying out this work.

EXPERIMENTAL

Study area

The physicochemical parameters of ground water of 5 stations in Charcha Colliery were studied. The groundwater was collected from the sources (bore wells) the months of April to May 2012. The sampling locations, source and corresponding habitats are shown in Table 2.

Preparation of water samples

The samples were collected in clean polythene bottles without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labeled in the field. The temperatures of the samples were measured in the field itself at the time of sample collection.

Table 2. Sampling locations and corresponding habitats

1. Charcha Basti Drinking Water
2. Charcha Colony Drinking Water (Before Treatment)
3. Charcha Colony Drinking Water (After Treatment)
4. Shivapur Village Drinking Water
5. Charcha Colony Inside Bore Well Water (Hand Pump)

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Fig 1. Map of Korea district in Chhattisgarh And Chhattisgarh in India.

Analysis of water sample

Analysis was carried out for various water quality parameters such as pH, total dissolved solids, total hardness, total alkalinity, calcium, chloride and chemical oxygen demand (COD) as per standard procedures.

Determination of water quality parameters

The water quality parameters analyzed were; pH- measured using standard pH meter, total dissolved solids (TDS) by standard methods, calcium content by EDTA titrimetric method, chloride content by argentometric method, total hardness (TH) by EDTA, alkalinity by titrimetric method, and metals by spectrophotometric method.

Results and Discussion

Table 2.
BDL – Below Detection Limit All Parameters are in mg/l unless specified

S.N.	Parameter	Sampling Stations					IS:10500 Desirable Limit	Below Detection Limit
		1	2	3	4	5		
1	Colour	Colourless	Colourless	Colourless	Colourless	Colourless		
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	---
3	Taste	Agreeable	-	Agreeable	Agreeable	Agreeable	Agreeable	---
4	pH	7.69	8.34	7.42	7.56	7.75	6.5-8.5	<0.01
5	Alkalinity	112	56	44	164	176	200	<0.5
6	Total Hardness	196	104	84	284	292	300	<0.5
7	Iron	BDL	BDL	BDL	BDL	BDL	0.3	<0.05
8	Chlorides	32	14	18	74	88	250	<0.25
9	Dissolved Solids	338	198	148	Nil	Nil	500	<5.0
10	Calcium	46.4	24.0	19.2	484	492	75	<0.02
11	Manganese	BDL	BDL	BDL	BDL	BDL	0.1	<0.05
12	Sulphate	90	21	48	BDL	BDL	200	<1.0
13	Nitrate	-	-	-	58	79	45	<0.01
14	Fluoride	0.53	0.42	0.32	-	-	1.0	<0.01
15	Selenium	BDL	BDL	BDL	0.38	0.42	0.01	<0.01
16	Arsenic	BDL	BDL	BDL	BDL	BDL	0.05	<0.01
17	Lead	BDL	BDL	BDL	BDL	BDL	0.05	<0.05
18	Zinc	0.1	0.1	0.09	BDL	BDL	5	<0.005

The results of the physicochemical analysis of the groundwater samples S1 to S5, collected from 5 places in Charcha Colliery are presented in Table 2.

Temperature

The temperature was found to be in the range between 26.3 to 27.2°C during study. The higher value of water temperature observed in the present study could be attributed to the early summer months prevailed during the period of investigation.

pH

pH is considered as an important ecological factor and provides an important piece of information in many types of geochemical equilibrium or solubility calculation. pH is an important

parameter in water body since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes. The pH values fluctuated between 7.42 to 8.34 (Table 2). The limit of pH value for drinking water is specified as 6.5 to 8.5. The pH shows slightly alkaline trend. Generally pH of water is influenced by geology of catchments area and buffering capacity of water.

Total alkalinity

The standard desirable limit of alkalinity in water is 220 mg/L. The maximum permissible level is 600 mg/L. The mean value of alkalinity in the ground water of Charcha area was 110.4 mg/L (Table 2) which is within the desirable limit in all stations. The value of alkalinity in water provides an idea of natural salts present in water. These factors are characteristics of the source of water and natural processes taking place at any given time.

Chloride

Chlorides are important in detecting the contamination of ground water by waste water. The permissible limit of chloride in drinking water is 250mg/L. The values of chloride observed in S1, S2, S3, S4 and S5 were very low i.e. within the permissible limit. The presence of chloride in slightly higher amounts may be due to natural processes such as the passage of water through natural salt formations in the earth or it may be an indication of pollution from industrial or domestic use.

Total hardness (TH)

ISI has specified the total hardness to be within 300 mg/L of CaCO₃. Regarding total hardness fluctuating trends in its value were observed in all the 5 stations. The observed total hardness values were well within the limits. S5 has comparatively high TH value (292 mg/L) than others.

Total dissolved solids (TDS)

The average value of TDS in the ground waters of Charcha was 338 mg/L. ISI prescribed the desirable limit of TDS is 500 mg/L. The maximum permissible level is 2000mg/L. TDS values observed in S1, S2, S3, S4 and S5 were within the desirable limit. TDS in ground water may be due to ground water pollution when waste waters from both residential and dyeing units are discharged into pits, ponds and lagoons enabling the waste to migrate down to the water table.

Calcium

Calcium concentrations were found to vary from 19.2 to 492 mg/L. The upper limit of calcium concentration for drinking water is specified as 75 mg/L (ISI, 1983). The calcium hardness observed in all the S1, S2 and S3 stations are well within the desirable limits with a minimum of 19.2/L in S3 to a maximum of 46.4 mg/L in S1 whereas S4 and S5 shows very high concentration of Calcium.

Manganese

Mn concentration were found to be below detection limit. The Mn concentration observed in all the samples are well within the permissible limit.

Sulphate

Sulphate concentration were found to vary from 21 mg/l to 90 mg/l. And the concentration were found within the desirable limits.

Nitrate

Nitrate concentration were found to vary from 21 mg/l to 90 mg/l and the concentration were found within the desirable limits.

Fluoride

Fluoride concentration were found to vary from 58 mg/l to

90mg/l. And the concentration were found slightly higher from the desirable limits.

Selenium

Selenium concentration were found to vary from 0.38 mg/l to 0.42 mg/l and which is slightly higher than permissible limit.

Arsenic

Selenium concentration were found below the detection limit which indicates the water purity and samples are within limit.

Lead

Selenium concentration were found below the detection limit which indicates the water purity and samples are also within limit.

Zinc

Selenium concentration were found to vary from 0.09 mg/l to 0.1 mg/l which indicates the water purity and samples are within limit.

CONCLUSION

The analysis of the water quality parameters of groundwater from five different stations in Charcha Colliery in Korea district shows that the pH, TDS, alkalinity, chloride ion, total hardness, calcium, and other values are well within the permissible limits. In conclusion from the results of the present study it may be said that the groundwater of Charcha Colliery is fit for domestic and drinking purposes and need no treatments to minimize as no contamination was found. There is an increasing awareness among the people to maintain the groundwater at their highest quality and purity levels and the present study may prove to be useful in achieving the same.

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