ORIGINAL RESEARCH ARTICLE

PHYSICO-CHEMICAL ANALYSIS OF GROUND WATER SAMPLES OF JHARIA COAL MINING REGION, DHANBAD, INDIA

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ABSTRACT:

The study was carried out to assess the impacts of industrial and mining activities on the groundwater quality in Jharia coal mining region of Jharkhand State. Groundwater samples Twenty Nine (29 Nos.) were collected from various locations of the study area. The water quality parameters considered in the present study were pH, Temperature, Electrical Conductivity, Total Dissolved Solids, Alkalinity, Chloride, Nitrate, Sulphate, Bicarbonate,Total Hardness, Calcium, Magnesium, Sodium and Potassium.The pH of the analyzed groundwater samples varied from 6.2 to 7.6, indicating mildly acidic to alkaline in nature.Concentration of TDS varied from 301 to 923 mg/L and spatial differences in TDS values reflect the variation in lithology,surface activities and hydrological regime prevailing in the region. The quality assessment shows that in general, the water is suitable for drinking with some exceptions. However, EC, TDS, Cl,TH, Mg, Caand SO_4 values are exceeding the desirable limits at some site, making it unsafe for drinking.

KEYWORDS: Jharia coalfield; Water quality; Groundwater Level.

INTRODUCTION:

Groundwater is the most important water resource on earth. It comprises of the major and the preferred source of drinking water in rural as well as urban areas and caters to 80% of the total drinking water requirement and 50% of the agricultural requirement in rural India (Meenakshi et al. 2006). To prepare a sustainable management strategy for ground water development, it is important to understand the fluctuation of ground water levels with reference to natural or artificial recharge in space and time domain (Mushini V.S.R et al.2012). Groundwater is believed to be comparatively much clean and free from pollution than surface water. However, indiscriminate discharge of industrial effluents, domestic sewage and solid waste dump cause groundwater to become polluted and creates health problems (Patilet al.2010) The groundwater is a dynamic and replenish able natural resource, but in hard rock terrains its availability is of limited extent and is essentially confined to the fractured and weathered horizons, which points towards efficient management of groundwater in these areas(Saraf A.K.et al.1998). Due to the ever-increasing demand for potable and irrigation water and the inadequacy of available surface water, the importance of groundwater is increasing exponentially (Nagarajan et al. 2010). Hence, to utilize and protect valuable water sources effectively and predict the change in groundwater environments, it is necessary to understand the hydrochemical parameters of groundwater such as pH, electrical conductivity (EC), total dissolved solids (TDS),sodium absorption ratio (SAR), total hardness (HT), major anion (CO_2, HCO_3^-, Cl^-, and SO_4^{2-}) concentrations, and major cation (Ca_2, Mg_2, Na, and K) concentrations (Prasanna et al. 2010; Guendouz et al. 2003; Edmundset al. 2006).

The quality of the ground water depends on a series of geological, hydrological and mining conditions, which vary significantly from mine to mine (Younger et al. 2002). The ground water resource may act as potential water source in the water scare mining areas and by adopting a suitable water management strategy and treatment process, the mine water generated during mining operations may be harnessed and utilized to meet the regional water demand for domestic, industrial and irrigation uses (Singh,1994). The Gondwana sequence in the Jharia basin begins withTalchir Formation which is followed stratigraphically upwards by Barakar Formation, Barren Measures and Raniganj Formation. The oldest rocks are exposed along the northern margin and youngest formations are outcropped towards south in the western part of the basin(Sharma et al.1966; Chandra,1992).The effects of climate change on ground water will depend onthe ground water system, its geographical location, and changes in the hydrological variables (Alley,2001; Sophocleous, 2004).

Ground water is affected by climate change through various hydrological processes, and trends in climate variables will be reflectedin ground water trends. The response of ground water levels to key climate variables has been studied with both statistical models (Viswanathan, 1984; Bierkens et al.,) The quality of groundwater is the resultant of all the processes and reaction that act on the water from the moment it condenses in the atmosphere to the time it is discharged by a well..Ground water is affected by climate change through various hydrological processes, and trends in climate variables will be reflected in ground water trends. The response of ground water levelsto key climate variables has been studied with both statistical models (Viswanathan, 1984; Bierkens et al., 2001; KnottersandBierkens, 2001; Chen et al., 2002) Over burden of the population pressure, unplanned urbanization, unrestricted exploration and dumping of the polluted water at inappropriate place enhance the infiltration of harmful compounds to the ground water (Pandeyet al., 2009). The coal field has the vast number of streams and Damodar River of the area. the Damodar gets heavily polluted with coal effluent of coal based industries on rout in Dhanbad- Bokaro region (Tiwaryet al. 1994)Groundwater quality, i.e., of dissolved ion content, is mostly affected either by natural geochemical characteristics, including climate, lithology,mineral weathering, nature of geochemical reactions, solubility of salts, dissolution/precipitation reactions, ion exchange, wet and dry deposition of atmospheric salt, and evapotranspiration, or by various anthropogenic activities, such as agriculture, sewage disposal, mining and industrial wastes(Singh and Chandel, 2006; Nisi et al. 2008; Jiangand Yan, 2010).

The groundwater quality determination in recent times has gained importance owing to the reason of being affected by various contaminants. In order to obtain an adequate assessment of the groundwater quality of an area, distribution of various chemical constituents and the types of groundwater present are the prerequisites. In Jharia Coal mining area, it has been stated by (Ghosh et al. 1991) that over the years, water resource conditions had been affected due to unplanned mining history prior to 1970 and urban sprawl resulting in severe damage to the quality and water table. This has necessitated the need to develop an adequate groundwater resource management plan of the area with specific reference to identification of the processes responsible and their evaluation. The hydro geochemical conditions that is responsible for causing significant variations in groundwater quality.

MATERIALS AND METHODS:

Description of the Study area:

Jharia Coal mining area is one of the most important Coal mining areas in India. It is roughly elliptical or sickles shaped, located in Dhanbad district of Jharkhand lies between latitude $23^{o}39^{/}$ N and $23^{o}48^{/}$ N and longitudes $86^{o}11^{/}$ E and $86^{o}27^{/}$ E. It stretches from Chandanpura on the west to Sindri on the east. The grand chord Railway line passes along north of this Coal mining area. It is bounded in the North by Eastern Railway and in the south by Damodar River. The main component of the natural drainage in JCF is the Damodar River, a fourth order stream that flows approximately west to east and captures all the surface drainage from the JCF, the drainage pattern of the drainage system in the area is dendritic. There are eight major streams, a few perennials and the rest intermittent, which drains the JCF from north to south to join the Damodar River. They are Tisra, Chatkari, Katri, Khudia, Jamuniya, Kumari and Bansjora etc.

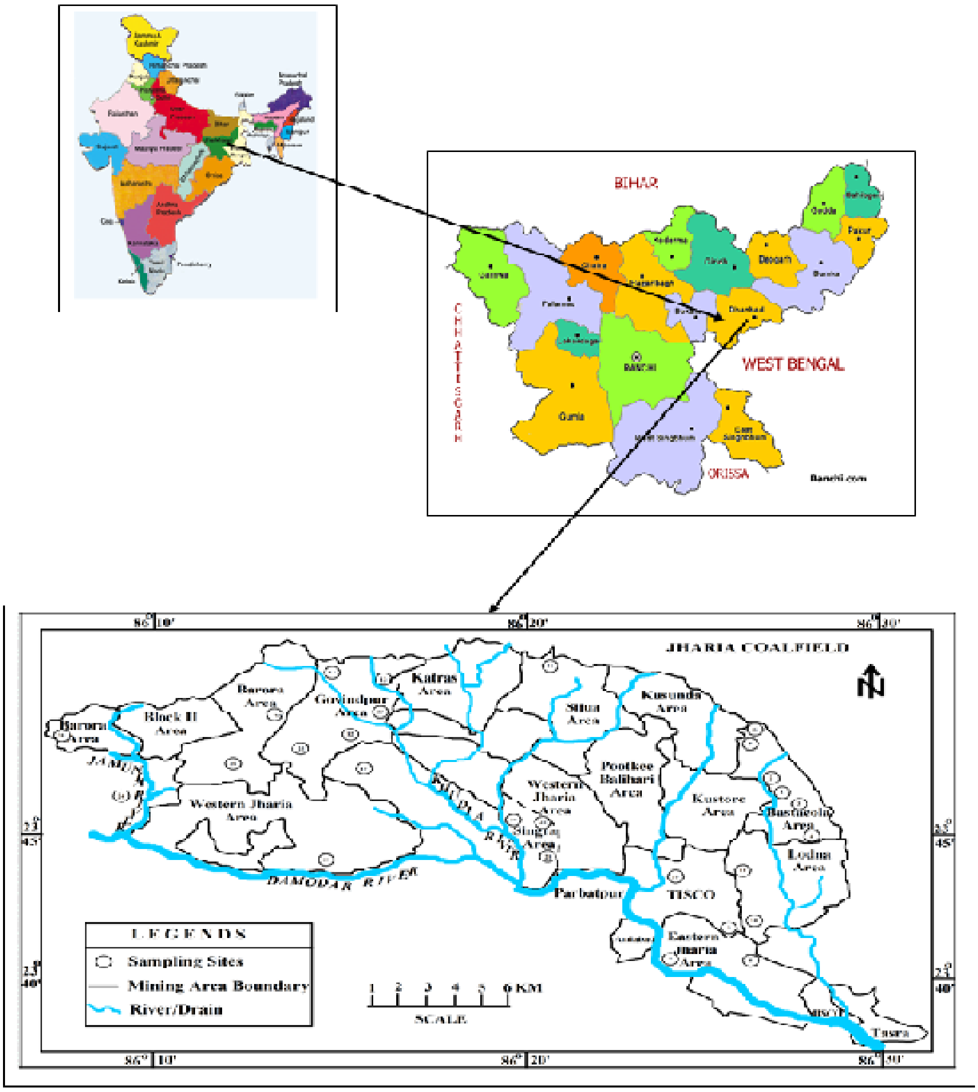

Table 1 Descriptions of Groundwater Sampling of Jharia Coal Mining Region:

Sr No	Sampling Location	Type	Latitude (N)	Longitude (E)	Elevation (Ft)
1	Near Victory	D/W	23°45’50.0”	86°24’43.9”	690
2	Bengali Koti	D/W	23°45’38.1”	86°25’14.9”	645
3	Ghanoodih	D/W	23°44’47.4”	86°26’14.2”	667
4	Goluckhdih	D/W	23°44’80.0”	86°26’33.0”	637
5	Dobari	D/W	23°45’20.2”	86°25’56.6”	638
6	Bera	D/W	23°46’01.6”	86°25’53.1”	656
7	Bhowrah South	D/W	23°40’41.3”	86°24’26.1”	526
8	Patherdih	T/W	23°40’36.8”	86°25’48.0”	652
9	Digwadih Campus	T/W	23°41’46.2”	86°25’19.3”	552

10	Bararee	T/W	23°43’25.9”	86°24’34.2”	623
11	Bhagamore	T/W	23°47’36.5”	86°18’06.6”	599
12	Lagarkha	D/W	23°48’9.00”	86°16’48.8”	671
13	AkashKinari	D/W	23°47’48.4”	86°16’11.2”	640
14	Govindpur	D/W	23°47’28.4”	86°15’54.5”	632
15	Sonardih	D/W	23°46’36.8”	86°14’20.6”	794
16	Tetulmari	D/W	23°48’05.8”	86°20’07.0”	675
17	MoonidihBazar	D/W	23°44"24.0”	86°20'49.2”	695
18	Baludih	D/W	23°44'04.1”	86°20'33.0”	671
19	Burdudih	D/W	23°43'57.5”	86°20'22.5”	626
20	manjhladih	D/W	23°43'59.0”	86°20'16.5”	653
21	Jatudih	D/W	23°44'52.0”	86°20'56.7”	646
22	Amdih	D/W	23°44'37.0”	86°19'45.0”	608
23	Sineedih	D/W	23°46’57.9”	86°15’06.9”	648
24	Damuda	D/W	23°46’07.5”	86°10’22.4”	693
25	Kharkharee	D/W	23°46’36.8”	86°14’20.6”	794
26	Phulawartar	D/W	23°46’35.6”	86°14’12.2”	690
27	Kesalpur	D/W	23°43’49.3”	86°18’42.9”	557
28	Barora	D/W	23°48’48.1”	86°14’17.1”	694
29	Mooraidih	D/W	23°48’15.6”	86°13’59.0”	330

(Note: D/W: Dug Well, T/W: Tube Well**)**

The climate in the Jharia Coal mining area is very pleasant during cold weather months starting from November to February. The occasional rain during the hot weather from March to June makes the climate, a little more comfortable for a time during mains. But from June to October the conditions are not on the whole very unpleasant during October to November. The days are warm and the nights are cool. There is relatively higher average rainfall along the northern margin of the field than in the Damodar valley. The general climate may broadly be described as the of the tropical monsoon belt. The temperature range in Jharia Coal mining area varies between 5ºCand 48ºC.

In the month of May and June, weather becomes very sultry due to high temperature and increasing humidity. The relative humidity is highest during the month of July to September. The annual rainfall in Jharia and adjacent region varies from 1197 mm to 1382 mm. This is the most exploited Coal mining area because of available metallurgical grade coal reserves.

Mining in this Coal mining area was initially in the hands of private entrepreneurs, who had limited resources and lack of desire for scientific mining. The mining method comprised of both opencast as well as underground. The opencast mining areas were not backfilled, so large void is present in the form of abandoned mining. Extraction of thick seam by caving in past at shallow depth has damaged the ground surface in the form of subsidence and formation of pot holes or cracks reaching upto surface, enhancing the chances of Spontaneous heating of coal seams and mine fire. This Coal mining area is engulfed with about 70 mine fires, spread over an area of 17.32 sq. km., blocking 636 million tonnes of coking coal and 1238 million tonnes of non-coking coal. Around 34.97 sq. km. area of the JCF is under subsidence. It is mentioned in JCF reconstruction program that 70% of the underground production of coal would come by caving and balance 30% by stowing and thus about 101 sq. km. underground mining area would be affected by subsidence. The other factor, which damages the land in JCF, is opencast mining and overburden dumps.

Physioraphy, Drainage and Climate:

The area has a flat to gently undulating topography with a general southerly slope towards Damodar River, which flows west to east beyond the southern boundary of the block. The highest ground elevation is about 149 m and the lowest elevation has been observed to be about 126 m. The drainage pattern in the present study area is dendritic in nature. The main drainage of the area is controlled by the Damodar River. . Apart from these a number of small ponds are found throughout the block. Most of the small ponds are formed due to illegal mine pits in the study area.

The area lies in the tropical region with fairly wide temperature variations between winter and summer. The climate of Jharia Coalfield is tropical monsoon type with maximum precipitation occurring in the months of June to September. The maximum temperature of the coalfield raises upto 44°C in May while it dips to 5° to 7°C in December/January. The annual rainfall in Jharia Coalfield and adjacent regions varies from 1197 to 1380 mm.

Based on porosity and hydraulic conductivity parameters, the rock formation of the area may be classified as hard and soft rocks. Hard rock mainly crystalline and consolidated sedimentary is characterised by very little porosity. Ground water in such rocks circulated to a limited extent through the secondary openings represented by joints, cracks, fissures and such other planes of discontinuity. Soft rocks represented by sandstone, pebbles and loose sand, posses higher degree of primary porosity and as such characterized by higher water storage capacity. As greater part of the study area is underlain by Precambrian crystalline rocks. The weathered residual of the hard rocks as well as the fractures, joints, fissures, faults and other zones of discontinuity are the principle repositories of ground water in the area.

Sample collection and preservation

A systematic sampling was carried for the assessment of ground water quality of Jharia Coal mining area. Representative 29groundwater samples were collected from different mines of Lodna, Bastacolla, Sijua, Western Jharia, Block-II, Barora, mining area of the study area. The groundwater samples were collected in one litre narrow-mouth pre-washed polyethylene bottles. Prior to each field work polyethylene bottles were washed in the laboratory with dilute hydrochloric acid and then rinsed twice with double distilled water. At the sampling sites, before collecting the samples bottles were also washed with the mine water. Suspended sediments were separated from the water samples in the laboratory by using 0.45 μm Millipore membrane filters.

RESULTS AND DISCUSSION:

Physico-chemical analysis of groundwater:

The collected groundwater samples were analyzed for different physico-chemical parameters such as pH, Electrical conductivity, Turbidity, TDS, Total hardness, Ca, Mg, Cl, etc. The results were compared with the Indian Standards (IS: 10500) for drinking purposes.

Hydrogen ion concentration (pH):

pH is a measure of the hydrogen ion concentration in water and indicates whether the water is acidic or alkaline. The measurement of alkalinity and acidity of pH is required to determine the corrosiveness of the water. The pH of the ground water samples were found to be ranging from 6.9 to 7.6 (Fig. 2). The water samples are slightly acidic to alkaline in nature.According to World Health Organization (W.H.O) low pH is likely to give rise to off taste and to promote corrosion. Limit is 6.5 to 8.5 (W.H.O).Electrical conductivity is a measurement of water's capacity for conveying electric current and is directly related to the concentration of ionized substance in the water.

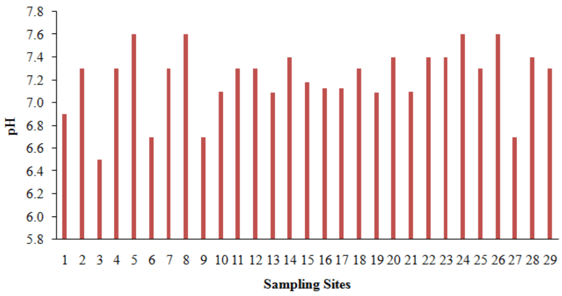

Figure 2: Variation of pH Values in Study Area

Table2: Physicochemical parameters of Groundwater of Jharia Coal mining Region

S	pH	EC	TDS	Turb.	TA	TH	Cl^-	HCO_3^-	SO_4^{2-}	NO_3^-	Ca^{2+}	Mg^{2+}	Na^+	K^+

No.														
1	6.90	1130	790	1.5	120	91	52	182.8	46.0	13.9	17.7	11.5	26.1	6.0
2	7.30	810	560	1.4	80	203	70	154.0	156.8	8.5	47.0	20.8	32.8	4.5
3	6.50	1300	918	1.3	60	239	58	146.9	50.9	13.9	66.6	17.7	34.8	3.7
4	7.30	530	375	0.5	100	290	46	189.9	42.2	4.2	79.1	22.5	26.8	8.9
5	7.60	835	589	0.9	68	278	40	168.4	140.6	2.3	50.9	36.6	31.8	3.2
6	6.70	780	552	1.4	60	146	48	197.0	42.5	2.3	37.7	12.6	54.8	6.0
7	7.30	530	375	0.5	100	265	46	189.9	42.5	4.2	69.1	22.5	36.8	8.9
8	7.60	835	589	0.9	68	303	40	168.4	168.7	2.3	60.9	36.6	31.8	1.2
9	6.70	780	552	1.4	60	221	48	197.0	167.4	2.3	67.7	12.6	54.8	6.0
10	7.10	630	447	0.2	76	277	60	144.2	154.4	5.7	65.8	27.3	99.2	4.8
11	7.30	1300	923	0.1	44	297	30	140.9	188.5	6.0	72.6	28.0	33.0	3.2
12	7.30	1300	923	0.1	44	309	30	140.9	256.9	6.0	62.6	37.0	36.0	6.2
13	7.09	854	606	0.8	56	355	80	155.0	125.9	28.9	64.8	47.0	46.6	4.6
14	7.40	466	331	0.5	104	325	50	129.5	46.2	15.0	58.0	43.7	68.8	11.4
15	7.18	480	341	0.4	156	251	32	132.1	58.5	3.8	42.2	35.3	34.8	4.3
16	7.13	630	447	0.2	76	419	60	144.2	168.5	5.7	75.0	56.3	49.2	7.8
17	7.13	630	447	0.2	76	491	76	144.2	167.5	5.7	85.8	67.3	39.2	8.8

18	7.30	1300	923	0.1	44	335	37	140.9	57.5	6.0	9.6	75.7	11.1	6.2
19	7.09	854	606	0.8	56	354	58	155.0	144.5	28.9	66.8	45.4	16.2	11.6
20	7.40	466	331	0.5	104	375	50	129.5	154.4	15.0	78.0	43.7	48.8	1.4
21	7.10	480	341	0.4	156	276	23	132.1	42.0	3.8	52.2	35.3	44.8	1.3
22	7.40	723	513	5.3	44	230	34	115.6	256.4	9.6	45.1	28.6	58.6	6.7
23	7.40	723	513	5.3	44	232	34	115.6	142.4	9.6	45.8	28.6	48.6	5.7
24	7.60	835	589	0.9	68	476	40	168.4	256.2	2.3	80.9	66.6	41.8	6.2
25	7.30	530	375	0.5	100	290	46	189.9	64.2	4.2	79.1	22.5	36.8	8.9
26	7.60	835	589	0.9	68	262	40	168.4	43.4	2.3	60.9	26.6	41.8	6.2
27	6.70	780	552	1.4	60	121	48	197.0	198.5	2.3	27.7	12.6	64.8	6.0
28	7.40	723	513	5.3	44	255	40	115.6	68.4	9.6	55.1	28.6	68.6	5.7
29	7.30	530	375	0.5	100	290	46	189.9	68.9	4.2	79.1	22.5	36.8	8.9
Min	**6.5**	**466**	**301**	**0.1**	**44**	**91.4**	**23**	**115.6**	**42.0**	**2.3**	**9.6**	**11.5**	**11.1**	**1.2**
Max	**7.6**	**1300**	**923**	**5.3**	**156**	**491.0**	**80**	**197.0**	**256.9**	**28.9**	**85.8**	**75.7**	**99.2**	**11.6**
Average	**7.2**	**779.3**	**551**	**1.2**	**77**	**284.6**	**47**	**156.7**	**121.4**	**7.9**	**58.8**	**33.5**	**43.3**	**6.0**
Stdev	**0.3**	**262.7**	**185.6**	**1.5**	**31**	**89.7**	**13.6**	**26.5**	**71.5**	**7.1**	**19.0**	**16.9**	**17.6**	**2.7**

Electrical Conductivity and Total dissolved solids (TDS):

Conductivity is ability of water tocarry an electrical current. This ability mainly depends on presence of anion and cations in water and also depends on mobility, valence of ions and temperature. It is the measure of the mineralization and indicative of the salinity of ground water. The electric conductivity with 400 micro-mhos/cm at 25^{o}C is considered suitable for human consumption. The overall conductivity ranges from 466 µS/cm to 1300 µS/cm groundwater of study area.

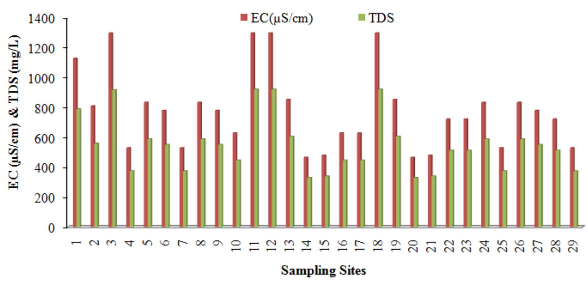

Figure 3: Variation of EC and TDS

The total dissolved solid consists of inorganic substances. The principal constituents of total dissolved solids are calcium, magnesium sodium, bicarbonates, chlorides and sulphates. The palatability of water with a TDS level less than 600 mg/L is generally considered to be good whereas at TDS level greater than 1200 mg/L in drinking water becomes increasingly unpalatable (WHO, 1984).the TDS were varied from 301 mg/L to 923 mg/L (Fig 3).

Temperature:

Temperature is one of the most important ecological and physical factors which have profound influence on the biotic and biotic components of the environment. Temperature helps in controlling the solubility of gases. The water temperature of all the samples analysed did not have much variations and was between 25^0-28^{0}C.

Alkalinity and Total hardness:

Alkalinity desirable limit is given 16.0 mg/L to 188.0 mg/L under WHO guidelines and it varies between 44 mg/L to 156mg/L in the study area. The total hardness (TH) of the analyzed water samples of the study area varies between 44 mg/L to 562 mg/L and (Avg. 233 mg/L) respectively indicating hard to very hard types of water (Table 4). Hardness of the water is property attributable to the presence of alkaline earths i.e. Ca and Mg. The data indicate that 10 groundwater samples have TH values higher than 300 mg/L, which is the potable limit (BIS 1991).Hardness has no known adverse effect on health but it can prevent water from the formation of lather with the soap and increases the boiling point of the water. The high TH may cause the encrustation on water supply distribution systems. (Fig 4)

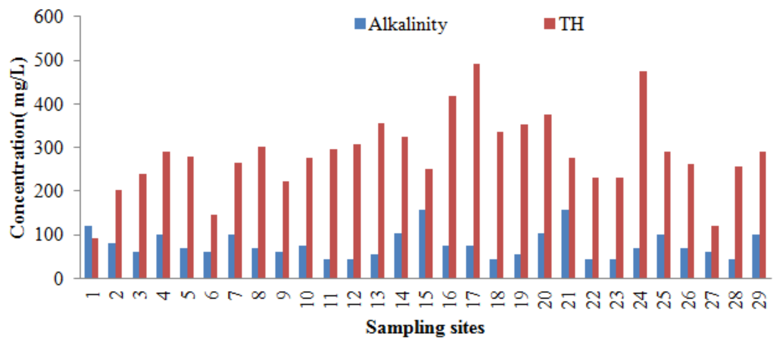

Figure 4: Variation of Total Hardness and Alkalinity Concentrations

Table 3: Range of chemical parameters in study area and WHO and Indian Standard (IS: 10500) for drinking waters

Parameters	Water Samples	WHO (1997)		IS:10500 (BIS 1991)	
	Range	Highest Permissible	Max. Desirable	Highest Permissible	Max. Desirable
pH	6.5 -7.6	6.5-9.2	7.0-8.5	8.5-9.2	6.5-8.5
EC	466-1300	1,500	750	-	-
Turbidity	0.1-5.3				
HCO_3^-	115-197	600	200	600	200
TA	44-156				
Cl^-	23-80	600	250	1,000	250
NO_3^-	2.3-28.9	50	-	100	45
SO_4^{2-}	42-256	600	200	400	200
Na	11.1-99.2	200	50	-	-
Ca	9.6-85.2	200	75	200	75
Mg	11.5-75.7	150	30	100	30
K	1.2-11.6	200	100	-	-
TDS	301-923	1,500	500	2,000	500
TH	44-562	500	100	600	300

Table 4: Hardness Classification of water

Hardness(mg/L)	Water Class	No. of samples
0-75	Soft	8
75-150	Moderately hard	5
150-300	Hard	6

>300	Very hard	10

Chloride:

Chloride a major anion in potable and industrial water has no adverse effect on health, but imparts bad taste to drinking water. A high concentration of chlorides affects growth of vegetation and imparts an increase in corrosiveness of metals. Chloride in excess of 100mg per litre imparts a salty taste and may cause physiological damages. Water with high chloride content us. The chloride content in the study area varies from 23 mg/L to60in the groundwater. Usually has an unpleasant taste and may be objectionable for some agricultural purposes. (Fig 5).

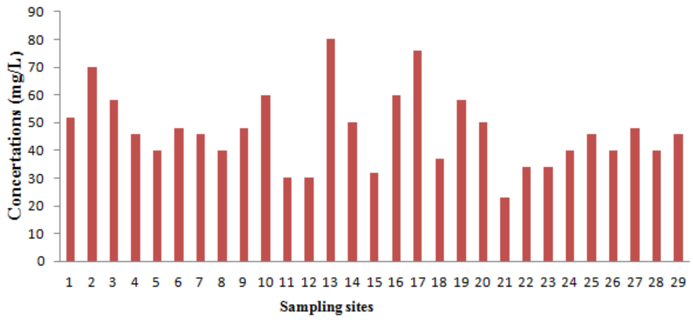

Figure 5: Variation of Chloride Concentrations in Study Area

Calcium and Magnesium:

Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) ions are both common in natural waters and both are essential elements for all organisms. Calcium and magnesium, when combined with bicarbonate, carbonate, sulphate and other species, contribute to the hardness of natural waters. The effect of this hardness can be seen as deposited scale when such waters are heated. Normally hardness due to calcium predominatesalthough in certain regions, magnesium hardness can be high. In some river catchments, hardness can vary seasonally reaching peak values during low flow conditions. Calcium is one of the principle cation in groundwater .the calcium is most abundant element in human body, which required 0.7 to 2.0 gm/day., It also helps in the formation of bones and teeth. The Highest desirable level of calcium in drinking water is 75 ppm and maximum permissible level is 200 ppm (WHO, 1984).The range of calcium ions was 9.60 mg/L to 85.62 mg/L. The maximum Calcium was found to be 85.62 mg/L in groundwater of Moonidih of Jharia coal mining area which was beyond the desirable limit.

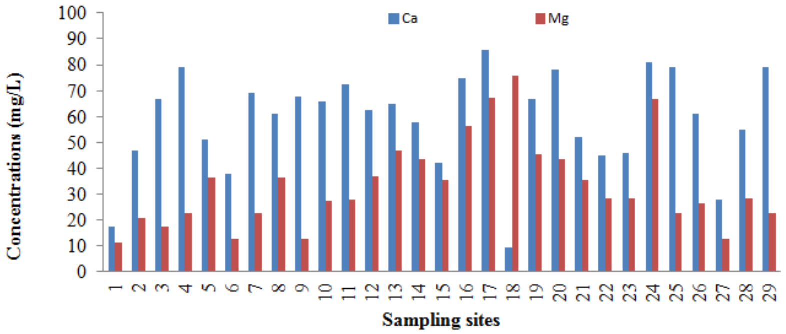

Figure 6: Variation of Calcium and Magnesium Concentrations in Study Area

Magnesium is the most important alkaline earth metal present in ground water .it is the one of the most important contributor to the hardness of water. The lower concentration of magnesium is not harmful but higher concentration is laxative. According to (WHO,1984) and the maximum acceptable limit of magnesium in drinking water is 30 mg/L. The magnesium ranged from 11.45 mg/L to 75.69 mg/L in the water samples of the study area. (Fig 6)

Sulphate and Bicarbonate:

High concentration of sulphate in association with Sodium or magnesium in the drinking water might give rise to gastrointestinal irritation. According to the IS:10500 the desirable limit is 200 mg/L. The sulphate in the water samples ranged from 41.3 mg/L to256 mg/L. According the WHO limit is 400 mg/L. low concentration is physiologically harmless. The overall concentration of sulphate in th study area is within the safe limit.

The bicarbonate concentration of the study area was 115.6 mg/L - 197 mg/L. The maximum bicarbonate concentration was found in block II area. The ground water containing 600 mg/L of bicarbonate is considered fairly safe and good domestic purpose. (Fig 7)

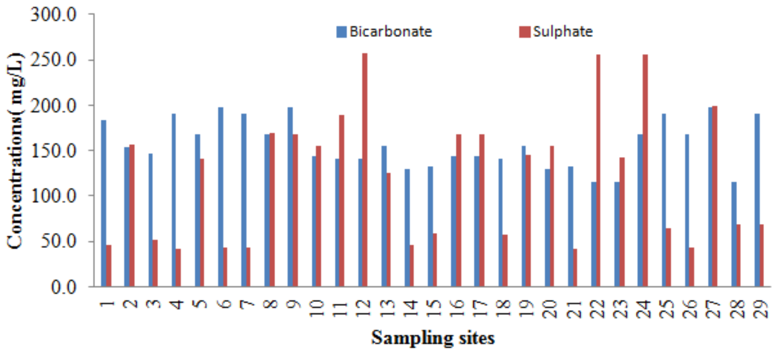

Figure 7: Variation of Bicarbonate and Sulphate Concentrations in Study Area

Sodium and Potassium:

The sodium concentration in the water samples was found between 11.45 mg/L to 99.2 mg/L. The desirable limit for sodium is given as 200 mg/L according to WHO (1984) guidelines.(Fig 8)

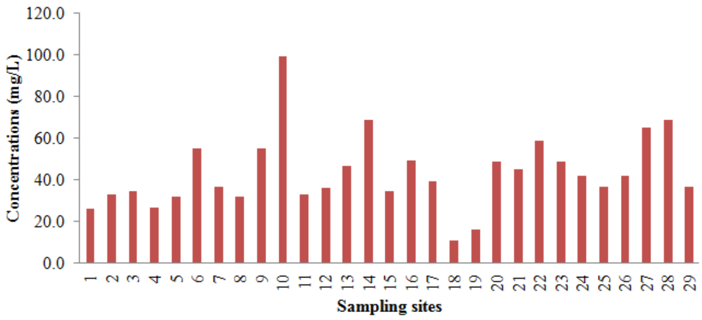

Figure 8: Variation of Sodium Concentrations in Study Area

Potassium is less common cation in the groundwater. in the water samples was 1.2mg/L to 11.60 mg/L .(Fig 9)

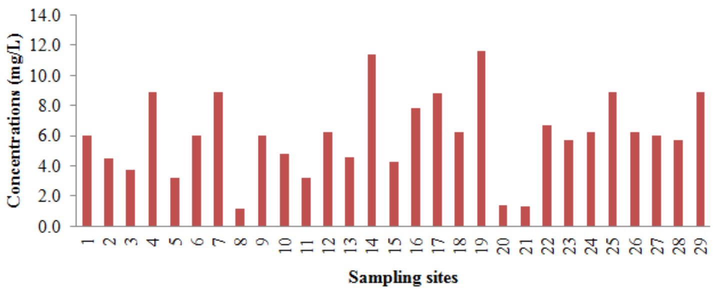

Figure 9: Variation of Potassium Concentrations in Study Area

Nitrate:

Nitrate is the most highly oxidized form of nitrogen compounds commonly present in natural water. Nitrate poisoning in infant animals including human, can cause serious problems and even death. Nitrate poisoning has been referred to as the 'blue baby' syndrome, although the correct term is 'Methenoglobinemia'. The Nitrate content in the Mine water samples varied from 2.3 mg/L to 28.94mg/L .The Highest desirable level of Nitrate in drinking water is 45 mg/L as per IS:10500. The high value of Nitrate is due to the use of Explosives of ammonium Nitrate base and use of Fertilizer in agriculture. (Fig 10)

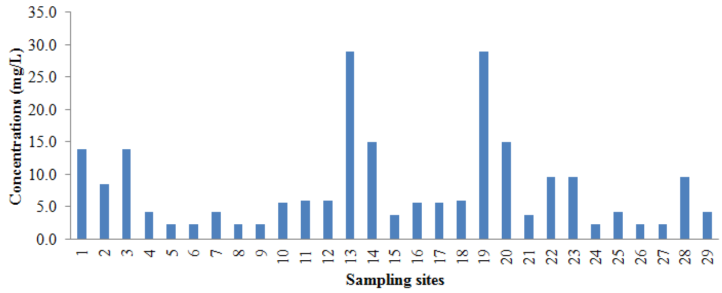

Figure 10: Variation of Nitrate Concentrations in Study Area

CONCLUSION:

For drinking water quality assessment of the groundwater evaluated in terms of physicochemical analysis. Also the groundwater quality data were compared with the prescribed limits of WHO (1997) and Indian Standard for drinking water (IS-10500). The pH values indicating slightly acidic to alkaline in nature. The quality assessment shows that in general, the water is suitable for drinking with some exceptions. However, EC, TDS, Cl, TH, Mg, Caand SO_4 values are exceeding the desirable limits at some site, making it unsafe for drinking.

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