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A Study about Ecological Imbalance in Surguja (India) Coalfield Area Due to Mining

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Abstract

The present investigation has been focused on Bishrampur and Bhatgaon regions of Surguja Coal field area since these are major coal mining areas of Surguja district which are prone for ecological imbalance. The sampling method was based on primary and secondary data collection during the research study in three areas namely Coal mining area, Forest area, and Urban area. The water samples were collected in the month of November'2010 from hand pumps, tube wells and ponds, and were considered under primary data collection technique and their Temperature, p^H, E.C, TS, TDS, TSS, Alkalinity, TH, DO, BOD, COD, F^-, Cl^-, SO_4^{2-}, NO_3^- etc. were determined using pH meter, titration, water analyzer and spectrophotometer etc. It was found that deteriorating water quality due to mining, continued to ruin the health standards of local peoples, reduced the number of flora and fauna, reduced the agricultural land area and it constrained the farmers to migrate, this led to an increased entropy in ecology of Bishrampur and Bhatgaon regions, causing an ecological imbalance.

Keywords: Physico-chemical parameters, water analysis and ecological imbalance. **Abbreviations:** EC- Electrical Conductivity, TS- Total Solids, TDS- Total Dissolved Solids, TSS- Total Suspended Solids, DO- Dissolved Oxygen, BOD- Biological Oxygen Demand, COD- Chemical Oxygen Demand, TH- Total Hardness.

Introduction

Bishrampur is located 28 kms away from Ambikapur in Surguja district, Chhattisgarh. Bhatgaon village is situated in north-eastern side of Bishrampur and 20 kms away from it. Many open and underground mining centers are located in and around Bishrampur. However, the last decade has seen large scale unregulated SECL mining, residential and commercial expansion, over straining the water resources and generally defunct civic amenities. Due to excessive mining in Bishrampur (Vishrampur) and Bhatgaon and its surrounding areas air, water and soil are continuously getting polluted. Water is an important asset of ecology, since life without water is impossible. The average rain fall in this area is 1100 mm. Scarcity and lack of pure drinking water in the ecology will create disorder leading to ecological imbalance. Water is the most essential commodity for human consumption, without it no life can exist. Pure drinking water resources are dwindling due to deforestation, mining and industrialization. Approximately 71% of the earth surface is covered with water, mainly in the form of oceans. Around 2% of the water is present in glacier and ice caps. The actual fresh water is available for human consumption is around 1% of the total earth water. Ground and surface water used by men are of different characteristics. Ground water contains dissolved minerals from the soil layers through which it passes. Surface water contains a lot of organic matter and mineral nutrients[1-3]. Domestic waste includes human excreta, papers, cloths, soap and detergents etc, these are the major part of water pollutants. Uncontrolled dumping of wastes of rural areas, towns and cities into the ponds, lakes and stream of rivers, is being observed. Due to accumulation of sewage and other wastes into the water resources they are no longer remain recyclable; as a result their self regulatory capability is lost. Water being polar solvent has the property to dissolve these polar impurities. The decomposition of these wastes is largely an aerobic process which in turn takes up more and more oxygen from water rendering it low oxygen content[4-6]. So it is necessary to analyze the extent of pollutants present in the water in these areas and accordingly find remedy for it since it is primary requirement for living species[7-9].

Material and Methods

We had selected some ponds and bore wells in Bishrampur and Bhatgaon regions for our investigations. The analysis was carried out by the standard protocol[10-19] as mentioned below. Sampling spot for water analysis were named as BP_1, BP_2, BP_3 , BhP_1, BhP_2, BhP_3 (for surface water) and BW_1, BW_2 , BW_3, BhW_1, BhW_2, BhW_3 (for underground water). Water samples were collected in 2 liter Polythene jerry canes previously soaked with 8M. HNO_3 and then cleaned with detergent followed by rinsing with double distilled water. The collected water samples

were preserved in ice cooled chamber and kept in the dark room[14-15]. The entire chemicals used in the analysis were LOBA/BDH grade.

The following parameters were analyzed using standard procedures. Some parameters like Temperature, pH, E.C, and D.O. were analyzed instantly in the sampling spots with Electronic India made nine parameter analyzer kit (Model No.172). And the others were analyzed in the laboratory of pollution Control Board, Bilaspur, C.G. The results are tabulated in the table - 1 below.

Name of Parameter	Techniques
Temperature	Thermometer
pH	pH Meter
Conductivity	Conductivity Meter
TS, TDS, TSS	Dried Method at 103-105^{0}C and 180^{0}C
DO and BOD	Iodometric Method
COD	Reflux Method
Hardness	Titrimetric Method
Sulphate	Spectrophotometrically (HACH DR/2010, UK).
Fluoride	SPANDS Method
Chloride	Argentometric Method
Nitrate	Spectrophotometrically (HACH DR/2010, UK).

Results and Discussion

Pollution of both surface and underground water systems through anthropogenic activities is the major environmental problem faced worldwide. In and around Bishrampur and Bhatgaon, small and large mining fields are located. The underground drinking water quality in these regions continues to decline due to excessive underground mining. Owing to mining, aerosols containing mixed inorganic matter along with carbon particles are contaminating different water systems by mixing with water and finally causing pollution. The increasing pollution has increased the rate of vaporization of water too. Therefore we took this small project to assess the water quality status of various areas of Bishrampur and Bhatgaon regions. We selected main surface water at Bishrampur named as Pokhra Talab (BP_1), Talab Near Jainagar (BP_2), Gaurishankar Mandir Talab (BP_3) and Tube well Near Railway Station (BW_1), Hand Pump Near Jainagar (BW_2), Tube well Near SECL Hospital (BW_3) respectively. We also selected main surface water at Bhatgaon named as Pond Near Kalyani UG Mine (BhP_1), Bhatgaon Talab (BhP_2), Talab near Bhatgaon-Bishrampur Road (BhP_3) and Tube well Near Sivani Khadan (BhW_1), Tube well Near Jharia Chowk (BW_2), Tube well near Mission School (BhW_3) respectively. The results of the various selected parameters are tabulated in the table -1 and 2 for Bishrampur and Bhatgaon areas respectively and are discussed as follows:

Table-1
Water Quality of Bishrampur region

Parameter/ sampling spot	Surface water			Underground water			IS: 10500 Limit in (units and ppm)
	BP_1	BP_2	BP_3	BW_1	BW_2	BW_3	
Temperature	27.0	28.6	29.5	26.0	26.0	25.0	00
pH	7.60	7.67	7.61	6.5	6.80	7.10	6.5-8.5
Conductivity	764	769	775	750	786	749	00
TS	2246	2360	2463	1860	1669	1780	500-2000
TDS	1905	1760	1862	1662	1348	1261	500-2000
TSS	120	400	109	198	346	505	20-50
Alkalinity	602	598	493	636	679	511	200-600
Total Hardness	708	652	614	710	646	605	300-600
D.O	3.6	3.4	3.0	2.9	3.1	2.8	5
B.O.D	9.8	7.1	9.3	6.8	6.2	8.7	5
C.O.D	11.05	13.01	15.05	13.50	11.11	12.05	10
F^-	1.45	1.40	1.23	1.35	1.20	1.29	0.5-1.5
Cl^-	441	989	873	1021	1261	668	250-1000
SO_4^{2-}	253	345	298	301	398	251	200-400
NO_3^-	62	61	79	58	67	54	45

BP_1–Pokhra Talab, BP_2– Talab near Jainagar, BP_3–GauriShankar Mandir Talab, BW_1–Well near Railway Station, BW_2–Hand Pump near Jainagar, BW_3–Tube well near SECL hospital.

Table-2
Water Quality of Bhadgao region

Parameter/ sampling spot	Surface water			Underground water			IS: 10500 Limit in (units and ppm)
	BhP_1	BhP_2	BhP_3	BhW_1	BhW_2	BhW_3	
Temperature	29.0	27.0	27.0	25.0	26.0	26.0	00
P^H	7.1	7.2	6.9	6.9	6.7	6.6	6.5-8.5
Conductivity	754	762	769	750	716	749	00
TS	2054	2546	1963	1856	1966	1875	500-2000
TDS	1960	1654	1862	1662	1340	1161	500-2000
TSS	99	400	101	198	321	519	20-50
Alkalinity	602	598	493	636	654	511	200-600
Total Hardness	688	612	554	712	621	521	300-600
D.O	4.0	3.80	3.1	2.9	3.1	2.7	5
B.O.D	9.8	7.1	10.5	6.8	5.9	8.7	5
C.O.D	10.05	12.01	14.05	13.50	11.11	12.05	10
F^-	1.39	1.00	1.23	1.35	1.21	1.29	0.5-1.5
Cl^-	441	1012	883	1121	1111	467	250-1000
SO_4^{2-}	261	293	205	301	402	251	200-400
NO_3^-	58	61	87	58	67	76	45

BhP_1 –Pond near Kalyani UG mine , BhP_2 –Bhadgao Durga Mandir Talab, BhP_3 –Talab near Bhadgao-Bishrampur road, BhW_1 – Tube well near Sivani Khadan, BhW_2 –Tube well Near Jharia Chowk BhW_3–Tube well near Mission School.

Figure-1
Map of the study area

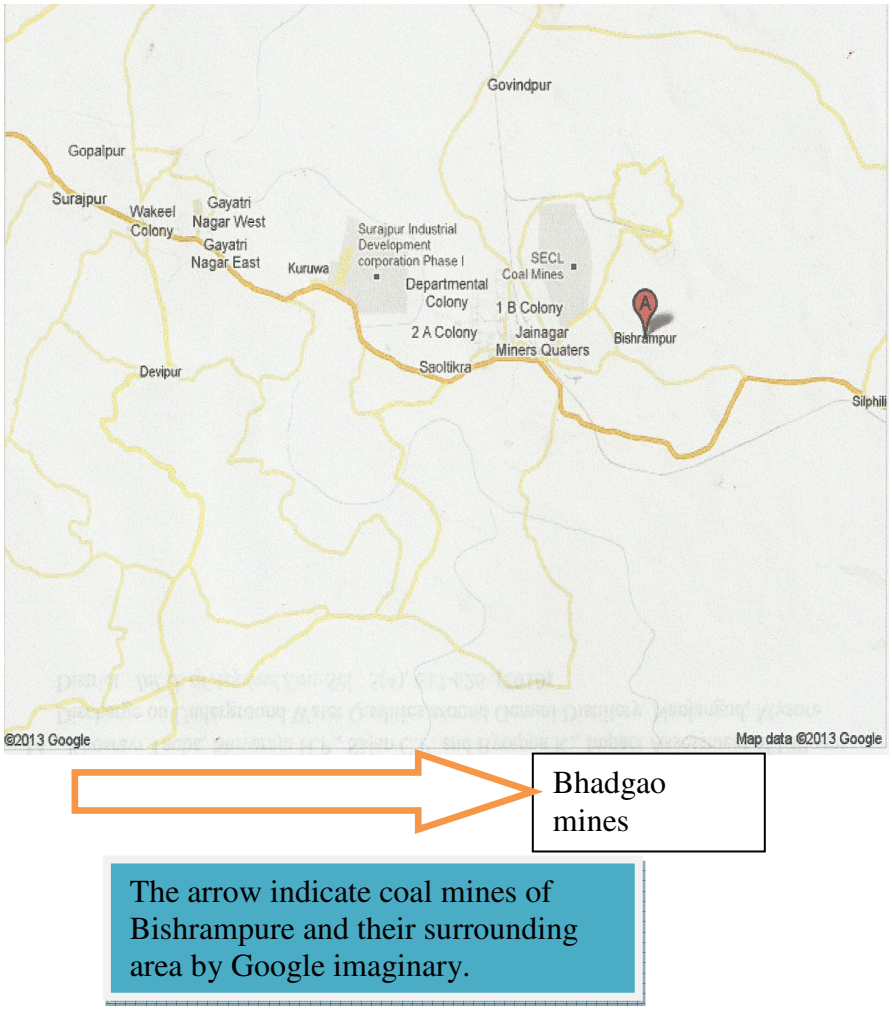

Figure-2
Map shown coal field area of Bishrampur, Ambikapur District, Chhattisgarh state

The pH, TDS, D.O., F^-, SO_4^{2-},TS, Alkalinity and Cl^- of BP_1 - BP_3 and BW_1 - BW_3 ,BhP_1 - BhP_3 , BhW_1 - BhW_3 were found within desirable limits. If TDS of water higher than permissible limits they can cause stone formation in human beings, D.O. is one of the most important parameters in assessing water quality and reflects the physical and biological processes prevailing in the water if its value is lower than 5 mg/L. Low fluoride level is linked with dental carries and high fluoride level may cause fluorosis and excess sulphate ions had laxative, cathartic effect on human health. The upper limit recommended 250 mg/L for human consumption. Higher values may cause gastrointestinal troubles in human beings. High concentration of sulphate is obtained due to the decomposition of organic substances in the lateritic soils. In the present study Conductivity, TSS, Total Hardness, BOD, COD, NO_3^- of all samples, Temperature of BP_2 and BhP_1, TS of BP_1 – BP_3, BhP_1 and BhP_2, alkalinity of BhP_1 and BW_1 – BW_2 , BhP_1 and BhW_1 - BhW_3, Cl^- of BhP_2 and BW_1 – BW_2 , BhP_2, BhW_1 and BhW_2 were found higher than the maximum permissible limits. Higher value of BOD indicates microbial pollution in samples, COD Values of all water samples were high is a definite indication of coal dust accumulation due to mining, excess of nitrate in water causes carcinogenic activities, the concentration of chloride in water is not exceeding 250 mg/L, if 1mg/L Chloride content in water, it affects fish and aquatic organisms.

Conclusion

The values of some physico-chemical parameter (temperature, TS, TDS, TSS, alkalinity, total hardness, BOD, COD, Cl^-, SO_4^{2-}, NO_3^- etc.) in the study of pond water and bore well water is higher than the recommended limit is an indication of pollution hazards. Both surface water and underground water are polluted. All these sampling locations are contaminated due to various mining activities, like coal washery, heavy transportation of coal by trucks, coal dumping and loading station and formation of dust due to blasting. The elevated values of these parameters are of great concern to public health when the water from these bore wells are consumed by people without treatment. Above results conclude that ecological

imbalance has occurred in Bishrampur and Bhatgaon regions of Surguja district due to mining, which can be minimized by proper water treatment and management.

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