STATUS OF CHEMICAL POLLUTANTS IN GROUND WATER IN DHANBAD (JHARKHAND)

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ABSTRACT

Ground water containing dissolved ions and toxic metals beyond the permissible limit is harmful and not suitable for drinking and other purposes. Coal mining by open cast method or by underground operations generates huge quantity of waste water which affects the ground water quality. A regular monthly monitoring of ground water from 10 sampling stations in Dhanbad area and its average annual estimation give a details picture of the pollution status. The C.O.D. Value at one sampling site near Lodna Bazar showed a higher than the desirable value. The excess quantity of iron is considered as nuisance. The parameters such or pH, total dissolved solids, turbidity, alkalinity, hardness, chlorides, sulphates, phosphates, iron etc. was analyzed. The estimated parameters were compared with the WHO standard and water quality was addressed using water quality index. The changes in quality of ground water are reported from all the mining areas of Dhanbad in response to pollution from coal based effluents. Thus, periodic monitoring of ground water quality of this area is necessary to access its suitability for drinking and other domestic purposes.

Keywords: *Tolerance, pH, B.O.D., C.O.D., TDS, WHO, Turbidity*

1. INTRODUCTION

Water is one of the "Elixir of life". Clean water is one of the basic necessities for sustaining life on the earth. Probably due to this reason, most of the civilization took shape on the bank of rivers. But development of civilization has got its own implications on the quality of water. Due to urbanization and industrialization, the rivers, streams and other water bodies are now being used as reservoir of domestic as well as industrial waste. The situation is so grave that even the ground water has also deteriorated in its quality. A proper management of water resource is not possible unless a regular and proper monitoring of water is done.

The water resource is greatly needed to bring about essential changes in physical and chemical characteristics of the raw material till the final product is formed. During this process various types of pollutants are also formed which come out of the industry in the form of efficient. Damodar basin is world famous for its coal mining. Coal mining by open cast method or by underground operations generates huge quantity of waste water which affects the water quality of nearby water bodies.

It is found that coal possess some inorganic impurities such as pyrites (FeS_2), marcarite, hamerite (MnS_2) and siderite which generally produces sulphuric acid and other soluble salts after coming in contact with air and moisture. This results into formation of Acid Mine Drainage (AMD) which deteriorates the quality of ground water. AMD also contain several dissolved inorganic constituents. The high concentration of dissolved constituents is due to two different processes:

- The oxidation of metallic sulphides results into high concentration of Iron, Manganese, Zinc, Copper, Lead and Arsenic.
- The silicates and bedrocks dissolve in acid and produces high concentrations of Aluminum, Silica, Calcium, Magnesium, Sodium and potassium.

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2. MATERIALS AND METHODS

2.1 Study Area

Studied area is Dhanbad Coalfield which situated in Eastern India at the heart of Damodar Valley mainly along the northern bank of the river. It is situated about 260 km Northwest of Kolkata in the state of Jharkhand. The pollutants produced by other coal based industries such as coal washeries, coke oven plants, thermal power plants are of diverse type. The coal washeries remove inorganic impurities of coal and reduce the moisture contents. The technique utilizes the difference between the density of coal minerals and the associated minerals. Coal is separated from the impurities on the basis of differential density. Suspended coal particles, oil and grease, and flocculating agents are generated as major pollutant of water.

2.2 Water Sampling

Ground water was collected from 10 sampling station in Dhanbad area during the month from January to December representing season i.e. autumn, summer, monsoon, and winter. It is seen that proper and full proof sampling is most important for accurate assessment of concentration of different pollutant present in ground water. The sample should be representable and its quantity should be easy to be transferred to laboratory and easy for analysis.

2.3 Preservation

For each sampling station, the water samples were filtered (0.45 m membrane filter, Milliporte) and stored in acid washed polypropylene bottles. In the same way, cleaning of plastic water and plastic bags was carried out by socking in 5% (v/v) HNO_3 for 24 hours and then rinsing with milli-Q water. Water sample taken for analyses of cations were preserved by acidification with 2 M HNO_3 acid. The total dissolved solids (TDS), electrical conductivity (EC); redox potential (ORP), dissolved oxygen (DO) and pH were measured at the site within a few hours of collection of samples using a portable Cyber.

2.4 Laboratory Method for water analysis

The physicochemical character of ground water for different sampling station was done according to the standard method given by Welch (1952), NEER (1981), APHA (1992). Thus, according to the above said the pH value of water is determined with the help of Lovibon pH comparator disc. The temperature of the water is measured by thermometer. The dissolved oxygen (DO) is measured by electrometric measurement of oxygen diffusion across a membrane and alkali iodide azide methods. Bio-chemical Oxygen Demand (BOD) is determined by incubating the sample for 5 days at 20° C in a BOD incubator.

Chemical Oxygen Demand (COD) test was also conducted. The total solid of the sample is measured by evaporation at 100° C in a water bath followed by gravimetric procedure. Total Suspended Solids (TSS) was also measured through whatman filtered paper. Total Dissolve Substance (TDS) is also calculated. In relation to this, contents of Iron, Fluoride, Chromium was also measured. Lastly, the most probable number (MPN) test was also conducted as per standard method (APHA, 2000).

Table 1. Physicochemical analysis of ground water at different sampling station in Dhanbad

Physicochemical analysis of ground water at different Sampling Station in Dhanbad												
Name of Sampling station	pH	D.O.	B.O.D.	C.O.D	T.S.	T.S.S.	T.D.S.	TOTAL IRON	HARDNESS	FLUORIDE	CHROMIUM	MPN/Coliform/100 ml.
1) Lodna Colliery Area (Well)	7.40	0.10	46.00	360.00	2388.00	423.00	1966.00	0.08	82.00	0.02	0.04	1600.00
2) Lodna Colliery	7.40	1.30	41.00	2800.00	2633.00	65.00	2369.00	0.34	121.00	Nil	0.04	38.00
3) Katras Project behind K.C. Com Well	7.00	5.00	2.00	65.00	1678.00	27.00	1643.00	Nil	380.00	Nil	Nil	900.00
4) Main Pond Katras Project Near K.C. Office	7.40	4.00	4.70	60.00	8149.00	83.00	7966.00	Nil	8.00	Nil	Nil	800.00
5) Dhansar Colliery	6.80	4.00	14.00	180.00	168.00	118.00	851.00	0.80	200.00	0.70	0.06	1200.00
6) West Moonidih Colleiry Well No .1	—	4.00	1.00	28.00	4922.00	810.00	4914.00	0.20	110.00	Nil	Nil	450.00
7) Well No. 2 West Modih Katras Area	–	6.00	10.00	40.00	36.00	65.00	7981.00	0.10	11.50	Nil	Nil	300.00
8) Well No. 4 South Jharia Colliery	6.80	1.40	15.00	80.00	3536.00	90.00	3646.00	Nil	386.00	0.93	0.04	130.00
9) Well No. 5 South Jharia Colliery	7.40	2.20	10.00	41.00	984.00	48.00	936.00	Nil	330.00	1.10	0.04	130.00
10) Well Water Sudamdhih	7.20	–	–	60.00	3655.00	8.00	46.00	0.90	244.00	0.60	0.02	1000.00

3. RESULT AND DISCUSSION

A general survey of ground water of the coalfield and regular monitoring of the quality of water is thus most essential because it reflects monthly monitoring of ground water from nearly hundred stations of coalfield and its average annual estimation gives a details picture of pollution status.

The pH of water varied from 6.3 to 8.6 which are slightly alkaline in nature and within permissible limit at all sampling stations. The D.O. value however presents an undesirable picture. The BOD level at different sampling stations showed a trend well within permissible limit. Only several stations selected showed higher BOD value. The COD value at a station showed a higher than the desirable value water bodies at Lodna. The total suspended solid varied from 120 mg/l to 2963 mg/l. The range of total suspended solid varied from 3mg/l to 3986 mg/l. In the same way, the range of total dissolve solid varied between 50 mg/l to 9395 mg/l in different sampling stations.

It is found that hardness of water in most of the area was much more than the permissible limit. This was because of high concentration of dissolve in organic salt. This makes the water unsuitable for various domestic purposes. The most serious aspect of pollution which was noticed at almost all stations is a very high MPN value of coliform bacteria which has made the groundwater of whole cola belt unsuitable for drinking. It has its implication in the form of various water borne diseases such as cholera, jaundice, gastrointestinal etc.

4. CONCLUSION

In the mine areas of Dhanbad, the main source of water includes the mine water. The ground water is mainly utilized for domestic needs and to a limited extent for irrigation and industrial purposes. The ground water abstraction is mainly through dug wells, bore wells, dug cum bore wells and filter point wells are also used for ground water abstraction in a very limited area. Main problem of water is in Dhanbad urban area comprising of Dhanbad municipal area, Jharia area, Jorapokhar, Pathardih, Jamadoba, Bhuli and Katras. Against the demand of 35.18 million gallons per day of water supply is only 17 million gallons per day. There is shortage of 18.18 million gallons per day. In summer season, scarcity of water is in alarming proportion. Maithon water supply scheme can be a good substitute for supplying surface water to Dhanbad urban areas.20 million gallons of water per day can be supplied from Maithon dam. One training programme on Rain Water Harvesting and artificial recharge to Ground water was organized at Central Mining research institute (CMRI) campus, Dhanbad.

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