ASSESMENT OF GROUNDWATER QUALITY AROUND NANDGAON COAL MINES, DISTRICT CHANDRAPUR (MAHARASHTRA)

Y K Meshram* and P P Chahande
* S.S.E.S. Amravati's Science College, Congress nagar Nagpur (M.S.) India,
Sevadal Mahila Mahavidyalaya, Nagpur

ABSTRACT:
In the present study, physico-chemical parameters of groundwater was done to assess the quality of water in villages around Nandgaon coal mines. In this study water samples from different places were taken and analyzed as per APHA/NEERI. Further each parameters of the collected water samples was compared with the standard desirable limit prescribed by Bureau of Indian Standards. The water quality is found to be usable in some cases while other water samples were found unfit for drinking purpose.

Keywords: Pollution, Ground water, Physico-Chemical Parameters, APHA, Nandgaon coalmines, Indian Standards, Water pollution.

INTRODUCTION:

Chandrapur, a city in Maharashtra, is a fast developing city due to industrialization and urbanization. Around Chandrapur, various industries such as BILT, MEL, NTPC, Coal mines, cement factories, which extensively discharge effluents into the water bodies and are very toxic and harmful. These toxic pollutants contaminated the water body which leads to the pollution of surface water and groundwater directly or indirectly. In our environment, water pollution is of major concern as it is damaging the environment as well as affecting human health. Chandrapur is considered to be the fourth most polluted city in India. In this study, assessment of water samples was done to evaluate the physicochemical parameters like pH, hardness, turbidity, chloride, alkalinity, sulphate, fluoride, BOD, COD and DO. Different samples were collected from different sites in order to assess the quality of water in and around Nandgaon coal mines district. The various parameters were analysed as per procedure laid down in the NEERI (1988) and APHA (2005). Results were compared with those standards for physical and chemical properties of portable/drinking water as recommended by BIS(2012) and WHO(1993). Freshwater resources need special care and attention to make them available and sustainable for the present and future generations. The environmental monitoring through water quality assessment should be a continuous process and regularly undertaken for a variety of purposes like testing the suitability of water for agricultural, industrial, and domestic purposes. Hence, it is necessary to measure the desired parameters of water following standard methods, to check whether they are in accordance with standards (Sawyer C. N, et al (2000). Therefore, various water quality parameters have been analyzed to assess the quality of water for drinking and irrigation purpose and many others (Tambekar, et al., (2012), Bobdey, A.D., (2014), Kodate, J.K.et al., (2007), Nagamani, C. (2015).

MATERIAL AND METHOD:

Study area

The selection of sampling site was decided using various uses of water by their location, relative

magnitude and importance. The chances of accidental pollution are also an important factor and should be considered. The samples were collected from 5 different sites and the names of the sampling sites from where the samples were collected are mentioned in Table 1.

Collection of samples

For sampling, the polyethylene bottles was soaked in 10% HCl for 24hrs and then thoroughly cleaned and rinsed with distilled water. Before sampling, each bottles was rinsed with sample water. The five Water samples collected from coal Mines, Nandgaon, Visapur, Irai river, Charwat village in the bottles, labelled them and brought to the laboratory. The temperature of all water samples were noted at the time of sampling. The samples were analysed for the parameters like pH, hardness, turbidity, chloride, alkalinity, sulphate, and fluoride, DO (dissolved oxygen), BOD(biological oxygen demand), COD(chemical oxygen demand). The airtight containers were preserved very carefully by adding chemical preservatives and by lowering the temperature (Chonde, et al., (2014). We used the standard analytical techniques/equipment such as for pH by pH meter, EC by using Conductivity meter, Turbidity by Turbidity meter, Alkalinity by Titrimetric method**,** Fluoride by Ion meter, Sulphate by Gravimetric method, Hardness by using EDTA Complexometric titration, Chloride by an Argentometric method, TDS by using TDS meter, DO by Wrinklers method**.** The obtained results after analysis was compared with Indian Standard Drinking water specification IS: 10500-2012 (Rajashekar, (2012), Tiwari, (2015).

RESULT & DISCUSSION

Temperature: It was found from Table no.2 that the temperature of water samples are within the permissible limits as per BIS standards (24-28°C).

pH: The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value of pH below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by BIS. In the present study, the fluctuation of pH in the samples is from 7.10 - 8.19 as shown in Table 2. According to pH these samples are safe for consuming.

Turbidity: In the present studies, Turbidity of all groundwater samples ranged from 0.22 to 3.06 NTU. However the prescribed limit of Turbidity for drinking water is upto 5 NTU as per BIS standards. The turbidity values at all sites are found to be below the acceptable limits being prescribed in BIS for drinking water.

Conductivity: EC of the samples is in range of 14 to 71 us/cm whereas BIS value is in the range of 0-50. Conductivity of coal mines water was found to be 71.379 which is not in the permissible limit as per BIS values, while other samples are within the permissible limit and safe for drinking purpose.

Hardness: Based on present investigation, total hardness varied from 93-326 mg/L shown in Table-2. However the permissible limit of Hardness for drinking water is 300 mg/L (BIS values). Hence, water samples except from coal mines are within the range and safe for drinking purpose. The calcium and magnesium hardness varied between 63-233 & 29-93mg/L respectively which showed that water samples collected from coal mines are not found within the permissible limit prescribed by BIS.

Alkalinity: In the present study Phenolphthalein Alkalinity was absent in all samples and Methyl Orange Alkalinity was ranged from 160 mg/L to 328 mg/L shown in Table 2. However the prescribed limit for total Alkalinity is 200mg/L as per BIS standards. Hence the samples A, B & D are highly alkaline in nature.

Chloride: In the study area there is no significant change in chloride concentration and

it ranged from 25.9 to 101.8 mg/L shown in Table-2. Chloride,which has been associated with pollution as an index was found below the permissible value set at 250 mg/L in most of the study area.

Sulphate: In the present study, the amount of sulphate was found to be in the range of 4.5-13.73mg/L as shown in Table-2. Hence these values are in the permissible range as per BIS Standards (200mg/L).

Fluoride: The concentrations of fluoride in collected samples were within the permissible limit as per BIS and hence water was safe for drinking.

DO: Dissolved oxygen content in water reflects the physical and biological processes prevailing in water and is influenced by aquatic vegetation. Low oxygen content in water is usually associated with organic pollution. DO from Table-2 is ranged from 5.1 to 6.8 mg/L in the study area, where as the prescribed limit for DO is 4-6 mg/L.

BOD: BOD values of water samples were found in the range of 2.1 mg/L to 3.6 mg/L. All the water samples were within the permissible limit (i.e. 0 to 5mg/L).

COD: COD determines the Degree of pollution in water bodies and their self-purification capacity. COD of water samples was in the range of 56-285 mg/L. As per WHO standards, COD should be below 250mg/L. Hence, (sample A) coal mines water has higher COD values than WHO standards. The data for COD is presented in Table-2.

CONCLUSION:

The average ranges of physical, chemical and biological characteristics of water quality are as per the ground water quality. The pH ranges from 7.10 to 8.19. The Temperature, Turbidity, Conductivity, Chloride, Sulphate and Fluoride are in the permissible range as per BIS standards. Also, biological parameters such as DO and BOD etc of all the samples are within

the permissible limit and hence can be used for drinking purpose.

However, Alkalinity, Hardness and COD were above the permissible limit and hence it can be used for other domestic purposes except drinking.

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Sr.No	Test	Sample A	Sample B	Sample C	Sample D	Sample E
1	Temperature	25.8	26.6	26.1	25.2	26.9
2	pH	8.19	7.12	7.23	7.82	7.10
3	Turbidity(NTU)	0.22	0.28	3.06	0.49	1.59
4	Conductivity((μS/cm)	71.379	32.136	14.008	35.123	23.690
5	Hardness (mg/L)	326	213	93	156	145
6	Calcium(mg/L)	233	183	63	109	90
7	Magnesium(mg/L)	93	29	30	47	55
8	Alkalinity (mg/L)	328	212	160	222	192
9	Chloride (mg/L)	101.82	63.50	25.99	88.01	49.62
10	Sulphate (mg/L)	13.73	9.21	4.52	7.68	3.43
11	Fluoride (ppm)	0.45	0.2	0.33	0.64	0.62
12	Dissolved oxygen	6.8	5.4	5.2	6.1	5.13.6
13	Biological oxygen demand(mg/L)	3.6	2.6	2.5	3.2	2.1
14	Chemical oxygen demand(mg/L)	285.33	1.9.33	176.00	56.00	146.66

Table 1: Description of water sampling sites

Sr.No	Source	Location
Sample A	Ground Water	Coal Mines
Sample B	Tube Well	Nandgaon
Sample C	Dug Well	Visapur
Sample D	River	Irai river
Sample E	Dug well	Charwat village

Table 2: Results of physico-chemical parameters of five sampling from chandrapur region