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STUDIES ON GROUND WATER QUALITY OF MANDIDEEP INDUSTRIAL AREA, BHOPAL

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Abstract

Groundwater is a precious source of water supply because of its relatively low susceptibility to pollution in comparison with surface water and its large storage capacity. In order to find out the impact of industrial effluent discharges on the ground water quality, water samples were collected from different sources near the Mandideep industrial area and analyzed for water quality parameters during the month of May 2016. Among different parameters studied in water samples, Ni, Cd, Zn, Sn, Pb were not found in the sample and Carbonates, Calcium, Magnesium, Sulphates, Chlorides, Nitrates, Sodium, Potassium, Iron, Fluoride, Turbidity, Alkalinity values are within the permissible limit. Electrical conductivity varies from 238-654.60µmhos/cm and pH is observed in the range of 6.82-7.74 which are meeting the desired criteria at all the locations. Analysis results of the samples were compared with the drinking water standards as per IS: 10500-2012.

Key words: Ground water quality, industrial area, electrical conductivity, pH

Introduction

Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Ground water acts as a channel for various viral and bacterial diseases through mixing of sewage and infiltration from pit toilets[1]. Different mechanisms like diffusion, adsorption, precipitation and decay have influence on the transport of pollutant in the groundwater. Water pollution is defined as the presence of toxic chemicals and biological agents in aquatic resources that exceed their desirable limit in the water and may pose a threat to the environment and human health. The health effects of drinking contaminated water may range from simple intoxication and stomach aches to deadly diseases or sudden death[2]. Precipitation in the form of rain and snowfall provide over 4,000 trillion liters of fresh water to India[3]. Most of this fresh water returns to the seas and ocean via the many large rivers flowing across the subcontinent. A portion of this water is absorbed by the soil and is stored in underground water resources. A much smaller percentage is stored in inland water bodies both natural (lakes and ponds) and man-made (tanks and reservoirs). Of the 1,869 trillion liters of water reserves,

only an estimated 1,122 trillion liters can be exploited due to topographic constraints and distribution effects[4]. The quality of groundwater in the state depending upon the litho logical character of the strata, climate conditions, effect of topography on rainfall distribution and other anthropogenic activities. The quality of water has deteriorated continuously due to the over exploitation of ground water, poor recharging, the inflow of chemicals used in the agricultural activities, industrial and domestic effluents, solid waste and accident spills. Many Indian cities are beginning to experience moderate to severe water shortages, brought on by the combined effect of agricultural growth, industrialization and urbanization. India's population is around 1.21 billion as on 1st March, 2011. The population of India is expected to stabilize around 1640 million by the year 2050. As a result gross per capita water availability will decline. India is water stressed today and the emerging scenario in the country is alarming. An estimate of 40% for India's evapotranspiration is significantly smaller than published estimates for a number of regions in the world[5]. The average annual per capita availability of water in the country, as per the 2001 census, was 1816 cubic meters which decreased to 1545 cubic meters as per the 2011 census[6]. As per the Ministry of Water Resources per capita water availability in 2025 and 2050 is estimated to come down by almost 36 percent and 60 percent respectively of the 2001 levels. Groundwater levels have reduced drastically in the last 60 years. Of all the 5723 blocks assessed across India by the Central Ground water Authority, 839 have been found to be over-exploited, 226 are classified as critical, while 550 are under the semi critical tag. Thus, around about 29 percent of India's ground water blocks are considered to be in need of very careful and judicious use henceforth.[7] Almost every river system in India is now polluted to a greater or lesser extent. Water pollution affects the entire biosphere of plants and organisms living in these water bodies, as well as organisms and plants that might be exposed to the water, hence the effect is damaging not only to individual species and populations, but also to the natural biological communities. It has been suggested that water pollution is the It has been suggested that water pollution is the most important worldwide cause of deaths and diseases[8, 9]. Therefore the basic resources air, land and water must be properly managed for human survival.

Study area

Mandideep is a town with municipality in Goharganj sub-district of Raisen district in the Indian state of Madhya Pradesh. Mandideep is 23 km From Bhopal and is basically an industrial township. Mandideep is situated at 23°08' North 77°53' East and 451 meters elevation above the sea level. The Mandideep Municipality has population of 59,654 of which 32,390 are males while 27,264 are females as per report released by Census India 2011. The average rainfall of Mandideep is 950mm. It has both large and small scale industries.

Figure 1: Location map of the study area

Sampling and method of analysis

On the basis of preliminary survey of the study area, water samples were collected in clean polyethylene bottles from different source hand pump, open wells and other sources of the areas near HEG limited Mandideep. The samples were collected in clean two liter polythene bottles. The temperature of the water samples was in the range 26-31°C. Analysis was carried out for pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), carbonates CO_3^{2-} calcium (Ca^{2+}), magnesium(Mg^{2+}), sulphate (SO_4^{2-}), chlorides (C1), nitrates(NO_3), sodium(Na+), potassium(K^+), iron (Fe), fluoride (F), turbidity(T) as per standard techniques (WHO, 2004, APHA 1995). Analysis results of the samples were compared with the drinking water standards as per IS: 10500-2012. The result showed acceptable limit of parameters.

Results and discussions

The global challenge today is how to protect our water resources which are continuously degraded by the growing population, urbanization, industrialization and over use of ground water. Initiate actions must be taken on all fronts by all of us to develop the groundwater aquifers through rainwater harvesting and artificial ground water recharge projects wherein people not only participate but are also the direct beneficiaries. The results of the study are shown in the table 1 and the following observations are made from the results. Hydrogen ion concentration is an important factor in water analysis since it influences acidity and alkalinity of water. The pH of the samples is found to be varying from 6.82 to 7.74. The value of conductivity depends on the minerals present. The conductivity varied from a minimum of 238 to a maximum of 654.60µmhos/cm. The maximum value is found in the sample S3 of area nearest to the industry. Turbidity is found to vary from 0.24 NTU to 1.3NTU with an average value of 0.713NTU. Total hardness is an important parameter for both domestic and industrial purposes. Hardness is found more in the sample of the area nearest to the industry. Alkalinity is varying from minimum value of 242 to a maximum of 382.72mg/l. Chloride concentration is varied from a minimum of 24.99 to maximum of 88.50 mg/l. Sulphates are more in the sample of the area nearest to the industry. Conductivity, pH, TDS, turbidity chlorides, iron, nitrates are

found to be in within the permissible limits over the entire study area. Amount of minerals were present below than the recommended level.

Conclusions

However for the entire study period most of the physico-chemical parameters of ground water of study area for all the three locations were within the prescribed limit of IS-10500 drinking water standard. It can be concluded that the ground water of the study area is safe for drinking purpose from the point of view of levels of EC, TDS, pH, Na^+, K^+, Ca^{2+} Mg^{2+} F^-, Cl^-, NO_3^-, SO_4^{2-}, PO_4^{3-} , it is required that some essential treatment is needed to maintain the quality and demand of water because the total hardness varied in between 210 to 390 mg/l indicated that water is moderately hard. Further research can be carried out at regular intervals to monitor the rate of contamination so that essential actions can be taken in time.

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Table 1: Physicochemical analysis of ground water of the areas near the industrial area of Mandideep

S. No	Parameters	S1	S2	S3	Max	Min	Requirement as per IS-10500-2012	
Method of test; APHA 22nd edition							Desirable limit	Permissible limit
1	Turbidity	0.24	0.6	1.3	1.3	0.24	5	10
2	Total dissolved Solids	260.00	278.00	340.80	340.80	260.00	500	2000
3	Total Hardness	210.00	256.00	390.00	390.00	210.00	200	600
6	Calcium hardness as CaCO3	132.00	172.40	295.00	295.00	132.00	-	-
7	Magnesium hardness as CaCO3	78.00	83.60	95.00	95.00	78.00	-	-
8	Total Alkalinity	242.00	254.00	382.72	382.72	242.00	200	600
9	Conductivity at 25°C (µmhos/cm)	238.00	462.50	654.60	654.60	238.00	-	-
10	Fluoride (as F)	0.03	0.05	0.02	0.05	0.02	1.0	1.5
11	Nitrates (as No_3)	2.55	6.04	4.32	6.04	2.55	45	No relaxation
12	Sodium (as Na)	24.64	31.26	44.40	44.40	24.64	-	-
13	Potassium (as K)	12.62	7.0	211.00	12.62	7.02	-	-

14	Manganese (as Mn)	0.01	N.D	0.01	-	-	0.1	0.3
15	Calcium as Ca	52.91	64.5	69.7	69.7	52.91	75	200
16	Magnesium as Mg	18.95	24.95	26,30	26,30	18.95	30	100
17	pH Value	6.82	7.12	7.74	7.74	6.82	6.5-8.5	No relaxation
18	Chloride (as CI)	24.99	79.90	88.50	88.50	24.99	250	1000
19	Sulfates (as SO_4)	37.76	86.80	230.70	230.70	37.76	200	400
20	Phosphates (as PO_4)	0.04	0.07	0.06	0.07	0.04	-	-
21	Total Iron (as Fe)	0.04	0.12	0.08	0.12	0.04	0.30	1.0

Note : All values except turbidity, Conductivity and pH are in mg/l

References

[1] Sunderrajan Krishnan and Rajnarayan Indu consultant, IWMI-Tata water policy research programmes, Anand, Ground water contamination in India: Discussing physical processes, health and socio-behavioral dimensions, India Pp-3-4

[2] What is water pollution, environmental pollution centers, 3-10-2018, p-6

[3] Water sector in India: overview and focus area for the future, PanIIT Conclave 2010, kpmg.com/in. p-1

[4] Seema Arora, Water for inclusive development: Industry's Role….-BW Businessworld, 28- 3-2017, p-1: businessworld.in/article/water-for-inclusive-development…/28-3-2017-115223

[5] S. K. Gupta and R. D. Deshpande, Water for India in 2050: first-order assessment of available options, Review article 1216 current science, Vol. 86, no. 9, 10 May 2004, 1216-1224

[6] Government of India, Ministry of Water Resources, Per Capita Availability of Water, Press Information Bureau, 27 April2015, 17:43IST

[7] Water sector in India: overview and focus area for the future, PanIIT Conclave 2010, kpmg.com/in. p-1

[8] Pink, Daniel H. Investing in Tomorrow's Liquid Gold, Yahoo.com, April 2006

[9] West, Larry, World Water Day: A Billion People Worldwide lack safe drinking water, About.com, 26-3-2006

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