Life Science Informatics Publications

Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences

Journal Home page http://www.rjlbpcs.com/

RJLBPCS

ISSN 2454-6348

Original Research Article **DOI - 10.26479/2016.0203.05**

PHYSICOCHEMICAL ANALYSIS OF GROUNDWATER AROUND AMBARNATH INDUSTRIAL AREA, MAHARASHTRA, INDIA

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ABSTRACT: Ground water quality around Ambarnath industrial zone was studied for a period of six months during June 2013 to January 2014. Groundwater samples were collected from 6 sampling sites during study period and analyzed for different physicochemical parameters like Temperature, pH, Conductivity, Alkalinity, Total hardness, TDS and Chloride. Obtained results were compared with WHO and BIS standard. An attempt has been made to find out the groundwater quality around industrial zone. Bhimnagar area open well and Kansai Gaon open well shows higher conductance value compared to other samples. During study period it was observed that open wells were found more affected compared to hand pumps and bore well

KEYWORDS: Physicochemical, bore well, water quality, Industrial zone.

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1.INTRODUCTION

Water is an important natural resource on planet earth. About 71percent earth surface is covered by water, which includes oceans, glaciers, ice caps, lakes, streams and underground reservoir. The availability of water on the earth's surface is in abundance, still it is a scarce resource due to its unequal distribution and its major portion occupied by saline water, and with this at many locations it is difficult to obtain desired quantity of water with its suitable purity. Since long time groundwater

is important resource on earth planet. With increasing population pressure on available water sources also increases. Available surface water resources are not sufficient to fulfill the increasing demand of man; therefore rely on groundwater sources increases in different parts of the world. India is the largest user of ground water. Presently about 65 % of the irrigation and about 90 % of the domestic and industrial water requirements are met through private ground water resources (MoWR, 2008). In India, 56 % of metropolitan, class-I and class-II cities are dependent on groundwater either partially or fully (NIUA, 2005; Patel et.al.2009). Towns smaller than this, mostly do not have access to imported water (mostly surface water from the nearby reservoirs). Hence overall dependence on groundwater for urban water supply in India is very high. Different manmade activities cause serious groundwater quality contamination. Pollution from effluent discharge by industrial areas, sewage infiltration, leakages, disposal of wastes, mining activity and sometime excess of nutrients from agriculture also leads to groundwater pollution. Once the groundwater get contaminated it is very difficult to restore it to the original water quality of the aquifer, therefore it is better to protect it first, rather than depending on new technology to clean the contaminated source (Sharma,2014). Water is such a medium which has unique properties of dissolving number of chemicals in it, therefore it is used as a solvent in number of industries and further it get contaminated easily as it is used as a medium of dilution. Water quality depends on the natural physical and chemical status of the water as well as any alterations that may have occurred as a consequence of human activities. Anthropogenic activities cause serious groundwater contamination; therefore it is important to analyze the ground water as well as water quality in different parts of the India, before using it for any purpose. Ambarnath is fastly growing town in which, urbanization and industrialization day by day increases, which leads to development of residential area around industrial area ,with this slum area also increases around industrial zone, in such slum areas lack of sanitation facilities, poor drainage system, inadequate waste management facilities were observed. The industrial effluents and sewage water from surrounding area may cause the contamination of underground water resources. People are using groundwater for different purposes; hence it is important to assess the groundwater quality of such area, in which improper sanitation facilities and lack of infrastructure are found. Therefore an attempt has been made to find out the groundwater quality around Ambarnath industrial zone.

2. MATERIALS AND METHODS

Ambarnath Chikloli-Morivali industrial zone is present in main Ambarnath town. It is important industrial zone in Thane district, surrounded by residential and slum area since few decades. 6 groundwater samples, within 2-3 km. vicinity around industrial zone were selected, and water samples were collected from selected sites during June 2013 to January 2014. Following sites were selected for study purpose.

Table No.1- Sampling Sites

Sampling Site	Station No.
Kansai Gaon (Ganesh chauk)Open Well	S-1
Kansai Hand Pump	S-2
Bhimnagar Area Open Well	S-3
Vadavli area Bore Well	S-4
Bhendipada area Bore Well	S-5
Samarth Service Centre Bore Well	S-6

Samples were collected in 2 lit capacities of clean polythene bottles. The bottles were rinsed with the groundwater to be taken for analysis. Tightly sealed after collection and labeled in the field area. Collected samples were analyzed for Temperature, pH, Conductivity, Alkalinity, Total hardness, Chloride and TDS parameter during study period. The temperatures, pH of the water samples were determined on the spot using a thermometer and portable pH meter respectively. Conductivity measured by conductivity meter, Total Alkalinity was determined by visual titration method using methyl orange and phenolphthalein as indicator. Total hardness was measured by EDTA titrimetric method using EBT indicator. Chloride contents by argentometric method using potassium chromate as an indicator. TDS determined by standard method. (APHA, Trivedi & Goel) The quality of groundwater has been assessed by comparing each parameter with the standard desirable limits prescribed by BIS and WHO.

3. RESULTS AND DISCUSSION

After analysis obtained results are shown in table no.2, 3.and further it was compared with the BIS and WHO standards from table no.4. (All parameter present in mg/l, except pH and Conductivity.)

Table No.2 – mean value of parameter for Monsoon Season (June2013-September 2013).

Station No.	Temp.	pH	Cond.	Alkalinity	Total Hardness	Chloride	TDS
S-1	24.25	7.06	367.8	207	205.5	117.51	166.5
S-2	23.88	7.73	358.3	154.5	160.5	108.63	149.8
S-3	24	7.61	765	156.5	165.5	128.51	350.8
S-4	24.25	7.9	424.3	163	210	119.28	159.3
S-5	23.75	7.64	327.8	162	159	111.12	169.5
S-6	24.38	7.44	298.3	190	156	121.77	152

Table No.3– mean value of parameter for winter Season (October 2013-January2014)

Station No.	Temp.	pH	Cond.	Alkalinity	Total Hardness	Chloride	TDS
S-1	23	7.53	391	220	214.5	106.86	160
S-2	22.8	7.9	351.5	164.5	167	102.95	147
S-3	23	7.85	797.3	168.5	171	117.86	349.3
S-4	23.08	7.91	407.8	178	224	106.86	155.8
S-5	22.9	7.91	373.5	175.5	166.5	99.4	164.5
S-6	23.08	7.48	291.3	200	197	106.86	142

Table 4: Drinking water standards

Sr. No.	Parameters	BIS (IS 10500-91)		WHO
		Desirable Limit	Max. permissible Limits	
1	P^H	6.5 to8.5	No relaxation	6.5 – 8.5
2	Conductivity (µS/cm)	-	300	-
2	Total dissolved solids (mg/l)	500	2000	1000
3	Total hardness as CaCO3(mg/l)	200	600	500
6	Alkalinity (mg/l)	200	600	200
7	Chloride (mg/l)	250	1000	250

Temperature

Temperature ranges from 22.9 ^{0}C to 24.38^{0}C., in monsoon season temperature ranges from 23.75^{0}C to 24.38^{0}C, and in winter season temperature ranges from 22.9^{0}C to 23.8^{0}C.During winter season temperature value decreases naturally compared to monsoon season, due to atmospheric changes.

pH

pH ranges from 7.06 to 7.91during study period of two season. In monsoon season pH was observed from 7.06 to 7.9 and during winter season it was found between 7.53 to 7.91. At station no. S 4 highest pH was observed during monsoon season and at station no. S4 and S5 highest pH was observed during winter season. All the samples were found within the desirable limit given by BIS and WHO. Exposure to air, temperature changes, and biological activities shows drastic changes in pH with time. In natural waters, pH changes diurnally and seasonally due to variation in photosynthetic activity which increases the pH due to consumption of CO_2 in the process (Trivedi and Goyal, 1986).

Conductance

During monsoon season conductance was ranged from 298.3 to 765 µS/cm, and during winter season it was ranged from 291.3 to 797.3 µS/cm. highest conductance was observed at station no. S3 during

both seasons. Except station no.S6, all samples were found above the BIS permissible limit. Electrical conductance increases with salts present in it, higher the electrolyte concentration in water, the more is its electrical conductance. Conductivity is proportional to the dissolved solids. Both showed analogous trend in seasonal variation (Gupta et.al. 2009).

Total Alkalinity

In monsoon season alkalinity observed from 154.5 to 207 mg/l and it was found within 164.5 to 220 mg/l during winter season. Slight increase in alkalinity was observed during winter season. Highest Alkalinity was observed at station no.S1 for both seasons. All the samples were found within the permissible limit given by BIS and WHO for Total Alkalinity. Natural water mostly found in alkaline form due to presence of sufficient quantities of carbonates. The major portion of alkalinity in natural water is caused by hydroxide, carbonate and bicarbonate. Alkalinity in itself is not harmful to human beings (Surve et.al. 2005, Shah et. al. 2008).

Total Hardness

Total hardness ranges from 156 to 210 mg/l during monsoon season and it was ranged from 166.5 to 224 mg/l during winter season. At station no.S4, highest hardness value observed for both the seasons. For total hardness all the samples were found within the permissible limit given by BIS and WHO. Hardness is caused by a variety of dissolved polyvalent metallic ions; predominantly Calcium and Magnesium cation, other cations like Barium Iron, Manganese, Strontium, and Zinc also contribute. The high concentration of Total Hardness in water Samples may be due to dissolution of polyvalent metallic ions from sedimentary rocks, seepage and run off from the soil (Gupta et.al. 2009).

Chloride

Chloride in study area ranges from 111.12 to 128.51 mg/l during monsoon season and it was ranges from 99.4 to 117.86 mg/l during winter season. At station no.S3, highest chloride was observed for both the seasons. Chloride present in all types of natural water. The high concentration of chloride in water is considered as an indication of pollution due to high organic waste of animal origin (Sisodia and Moundiotiya, 2006; Tripathi et.al.2013). All the samples were found within the desirable limit given by BIS and WHO for chloride during study period.

TDS

TDS ranges from 149.8 to 350.8 mg/l during monsoon season and it was found between 142 to 349.3 mg/l during winter season. At station no.S3, TDS was found highest for both the season. High total dissolved solids in groundwater may observed because of groundwater contamination, when waste water from residential and dying units were discharged into ponds, lagoons, pits; such waste water migrate down to the water table and causes contamination of groundwater (Shyamala et.al.2008). TDS were found between the desirable limit given by BIS and WHO during both season.

4. CONCLUSION

All ground water samples collected around Industrial zone were found within the permissible limit given by BIS and WHO for different parameter, except the conductivity parameter. In case of S3 and S1 sample i.e. Bhimnagar area open well and Kansai Gaon open well shows highest conductance during both season, indicates presence of dissolved material in it, which may be due to contamination around open well and seepage of waste water around the well side. It was observed that open well shows higher values of different parameter compared to bore well and hand pump area. Therefore water from open wells is not suitable for different purposes.

CONFLICT OF INTEREST

The authors declare that no competing financial interests exist.

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