*International Research Journal of Environment Sciences*_____ E-ISSN 2319–1414
Vol. **5(12),** 28-32, December **(2016)** *Int. Res. J. Environment Sci.*

Study of Some Physicochemical Parameters around Ambarnath Industrial Zone, India

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Available online at: www.isca.in, www.isca.me
Received 19th September 2016, revised 5th November 2016, accepted 6th December 2016

Abstract

Ambarnath town in Thane district of Maharashtra is having three major industrial zones. Ambarnath Chikloli-Morivali industrial zone is selected for study purpose. Study had undertaken to find out the effect of industrialization and urbanization on the groundwater. For the study purpose five ground water samples around industrial area were analyzed for physicochemical characteristics during Jan.2013 to June 2013. pH, TDS, Chloride, Sulphate were found within the permissible limits of BIS and WHO for all ground water samples. All groundwater samples were found above the permissible limits of BIS and WHO for turbidity. S1, S4 and S5 samples show higher Electrical Conductance during study period. Dissolved Oxygen was found lowest at S2, indicates contamination by organic material around the study area. Turbidity, Electrical Conductance and Dissolve Oxygen parameter indicates that water is not suitable for domestic and other purposes.

Keywords: Physicochemical Characteristics, Industrial zone, Urbanization, Groundwater.

Introduction

Along with the increase in population, demand for agricultural area, demand for land (residential area), urbanization and industrialization; also increases. Moreover, exploitation of natural resources for fulfilling the increasing demand also increases. Industries pollute the water, groundwater, air, and soil.

Water is a very important source on the earth planet, without this resource, survival of living system on earth is impossible. Within the last 2-3 decades; demand for groundwater has increased continuously. Groundwater fulfills the domestic needs of more than 80 % rural and 50 % urban population besides irrigation[1,2].

Due to anthropogenic activities, the quality of this important resource gets degraded. In today's scenario, there is a need of the groundwater quality assessment, before using it for any purpose, in any area, as industrialization and urbanization affects the water as well as the groundwater quality.

Industries play a very important role in the economy of our country. With rapid industrialization, pressure on available resources also increases. Man is not only using natural resources, but he is also discharging the different types of solid, liquid waste material into the same resources, which day-by-day degrading the quality of this vital resources.

Rapid growth of population, industrialization, high rate of urbanization and expansion of irrigation activities etc. increases ground water problem all over India[3]. Groundwater pollution has become a serious threat to mankind. Subsurface disposal of domestic waste water through septic tank absorption fields is one of the reason for groundwater contamination.

Groundwater contains dissolved minerals from the soil layers through which it passes. It may also carry some harmful contaminants along with other substances through the process of seepage from the surface water and biological activities. When groundwater contains high concentration of elements like fluorine, nitrate and other toxic substances, it is unsafe for drinking and domestic purposes[4]. Sewage systems are considered as one of the biggest source of waste and pollutants discharge to the environment[5,6].

Ambarnath is an industrially major developed town in Thane district of Maharashtra. Ambarnath area is having three major industrial zones. Ambarnath Chikloli-Morivali industrial zone was selected for study purpose as it is situated in main Ambarnath town surrounded by huge residential and slum areas. Therefore an attempt has been made to find out the effect of industrial effluents and domestic sewage on available groundwater sources.

Materials and Methods

For study purpose Ambarnath Chikloli-Morivali industrial zone was selected. Five groundwater samples, within 2-3 km. vicinity around industrial zone were selected. Water samples were collected monthly from selected sites during Jan. 2013 to June 2013. Following sites were selected for study purpose.

Table-1
Sampling Sites

Sampling Area	Station No.
Satish Service Centre Bore Well	S1
Vimko Naka area Bore Well	S2
Buwa Pada area Bore Well	S3
Laadi Naka Handpump	S4
Morivali Gaon Open Well	S5

Samples were collected in 2 lit. capacity 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 pH, Electrical Conductivity, TDS, Chloride, Turbidity, Sulphate and Dissolved Oxygen.

The pH of the water samples was determined on the spot using portable pH meter. Conductivity measured by conductivity meter, Chloride contents by Argentometric method using potassium chromate as an indicator. Turbidity and Sulphate measured by using Turbidimeter. Dissolved Oxygen was determined by using Winkler's Iodometric method. TDS was determined by standard method[7,8]. The quality of groundwater has been assessed by comparing each parameter with the standard desirable limits prescribed by BIS and WHO.

Results and Discussion

After analysis obtained results are shown in Table-2 and further it compared with the BIS and WHO standards from Table-3.

pH: pH was found between 7.16 to 7.87 at all sampling sites. All groundwater samples were found within the permissible limits of BIS and WHO. Highest pH was observed at station no.S1in the month of May 2013.Most of the times, in natural water pH is controlled by the carbon dioxide-carbon-bicarbonate equilibrium system. pH of water is influenced by geology of catchments area and buffering capacity of water[9] .

Electrical Conductivity: EC varied from 76 to 723 µS/cm during study period. Except S2 and S3 all groundwater samples show EC above the permissible limit given by BIS. Highest Electrical Conductance was observed at S5, i.e. Morivali Gaon Open well (723 µS/cm) in the month of June. 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[10].

Total Dissolved Solids: TDS was found between 54 to 422 mg/l during study period. All groundwater samples were found within the permissible limits of BIS and WHO. During Study period, for all months station S5, i.e. Morivali Gaon Open well shows highest TDS, compared to other samples. High total dissolved solids in groundwater may be observed because of groundwater contamination. When waste water from residential and dying units were discharged into ponds, lagoons, pits; such waste water migrates down to the water table and cause contamination of groundwater[9].

Chloride: Chloride was found between 92.3 to 142 during study period. All groundwater samples were found within the permissible limits of BIS and WHO. Highest Chloride was observed at S5 i.e. Morivali Gaon Open well in all month of study. The Chloride found in the groundwater due to minerals like apatite, mica, and hornblende and also from the liquid inclusions of igneous rocks[11,12].

Turbidity: Turbidity ranges from 5 to 17 NTU during study period. All groundwater samples were found above the permissible limits of BIS and WHO. Highest turbidity was observed at S5, i.e. Morivali Gaon Open well in the month of June 2013.Turbidity is an indication of water pollution, it causes because of source near the drainage channel, ditches or manure grounds, cesspool. In such areas, there are chances of having pathogenic organisms to be enclosed in the turbidity causing particles, which has chances to cause health hazards[13].

Sulphate: Sulphate ranged from 4.84 to 25.98 mg/l. All groundwater samples were found within the permissible limits of BIS and WHO. Highest Sulphate was observed at S4, i.e. Laadi Naka Hand pump in the month of Jan.2013. Many Sulphate ions are produced by oxidation process of their ores; they are also present in industrial wastes[14].

Dissolved Oxygen: D.O. varied from 1.4 to 4.2mg/l during study period. Standards for Dissolved Oxygen have not been set by BIS and WHO. Dissolved Oxygen at all sampling Stations was found below 5 mg/l (CPCB, 2008). Highest D.O. recorded at S1 and S3. Lowest D.O. recorded at station no.S2 i.e. Vimko Naka area bore well indicates contamination at sampling sites by anthropogenic activities. Oxygen decreases in water due to decomposition of organic matter, oxygen demanding wastes and inorganic reluctant rise in temperature[15].

Conclusion

pH, TDS, Chloride, Sulphate were found within the permissible limits of BIS and WHO for all ground water samples. Except S2 and S3, all groundwater samples show Electrical Conductivity above the permissible limit given by BIS, which indicates the presence of different ions in water, which leads to higher EC values. All groundwater samples were found above the permissible limits given by BIS and WHO for turbidity. Turbidity indicates the entry of dissolved material, silt into groundwater. Turbidity was observed highest at Morivali Gaon Open well, as open well is open in atmosphere, so chances of

contamination of water by different material increases. In the month of June turbidity was observed higher compared to other months. Dissolved Oxygen was found highest at Vimko naka area bore well, which is an indication of contamination at the sampling sites by anthropogenic sources and not suitable for domestic and other purposes.

Table-2
Obtained results during January 2013 to June 2013

Station No.	January 13	February 13	March 13	April 13	May 13	June 13
pH						
S1	7.82	7.84	7.86	7.85	7.87	7.86
S2	7.31	7.34	7.36	7.38	7.34	7.38
S3	7.16	7.16	7.18	7.23	7.24	7.21
S4	7.28	7.29	7.32	7.36	7.35	7.38
S5	7.65	7.64	7.66	7.68	7.69	7.65
E.Cond. (µS/cm)						
S1	292	312	326	346	349	362
S2	101	102	111	114	113	115
S3	76	79	80	82	83	88
S4	346	362	349	328	363	355
S5	646	684	698	701	714	723
TDS (mg/l)						
S1	161	164	168	174	178	178
S2	82	86	90	92	94	95
S3	54	56	59	62	64	69
S4	179	182	190	198	204	206
S5	396	400	408	416	422	420
Chloride (mg/l)						
S1	100.82	97.98	106.5	110.76	116.44	122.12
S2	95.14	92.3	95.14	96.56	103.66	112.18
S3	97.98	97.64	97.98	102.24	107.92	116.44
S4	107.92	110.76	110.76	116.44	119.28	126.38
S5	117.86	122.12	126.38	129.22	134.9	142

Station No.	January 13	February 13	March 13	April 13	May 13	June 13
Turbidity (NTU)						
S1	10	9	8	8	9	11
S2	6	7	6	5	7	8
S3	8	8	8	9	8	8
S4	10	11	10	9	9	10
S5	17	16	15	16	16	17
Sulphate(mg/l)						
S1	5.73	5.25	5.22	5.24	5	4.84
S2	6.25	6	5.94	5.84	5.62	5.54
S3	5.78	5.62	5.52	5.5	5.38	5.28
S4	25.98	25.34	25	25.34	25.14	25
S5	25.64	25.12	25	24.95	24.68	24.52
D.O.(mg/l)						
S1	3.3	3.4	3.6	3.8	3.9	4
S2	1.6	1.8	1.5	1.4	1.5	1.5
S3	3.8	4	3.9	4.1	4.2	4.2
S4	2.5	2.6	2.8	3	3.1	3.2
S5	2.2	2.2	2.5	2.4	2.7	2.5

Table-3
Drinking water Standards

Sr. No.	Parameters	BIS (IS 10500-2012)		WHO
		Desirable Limit	Max. permissible Limits in the absence of alternate source	
1	pH	6.5 to8.5	No relaxation	6.5 – 8.5
2	Ele. Conductivity (µS/cm)	-	300	-
2	Total dissolved solids (mg/l)	500	2000	1000
3	Chloride(mg/l)	250	1000	250
6	Turbidity (NTU)	1	5	5
7	Sulphate	200	400	-
8	Dissolved Oxygen	-	-	-

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