Research Paper Environment

Physico-Chemical Assessment of Groundwater Quality of Waluj Industrial Area, Aurangabad. (Maharashtra)

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ABSTRACT

A systematic study has been carried out to assess the physicochemical characteristics of water samples of Wells from Waluj MIDC area Aurangabad. The parameters were analysed such as Temperature, pH, Electrical Conductivity, Alkalinity, Nitrate, DO, BOD & COD. This research work shows that the water quality of the wells from Waluj MIDC area is deteoriated possibly due to increased of human activities and improper release of industrial effluents.

Keywords : Physicochemical Assessment, Groundwater, Industrial area.

Introduction

Aurangabad district comprises of varied topographic features and landscape consisting of high hills and low lying hills. Most of the hill ranges are located in the northern part of the district. The Satmala hills and Ajanta hills extend from east to west. The hills near Verul in Khultabad Taluka are part of these ranges which extend to Chawaka ranges and Aurangabad hills. The Satmala ranges encompass several hills overlooking the Tapi valley. From west to east they are Antur, Satonda and Ajanta town. The district is a part of Deccan Plateau, in general the slopes in the district are towards south and southeast within it are flat topped hill ranges extending over wide area hills separated by broad valley. Aurangabad city is surrounded by the hilly ranges from north, south and west sides at the altitude of 611 Mt. above mean sea level. Northern side Municipal limits are flanked Jathwada (Lakenvara) hill ranges and on south locally named Satara hills are located. General topography of the city is undulating. Altitude of the city increases towards north side. In Aurangabad city the average of rainfall is 725.8mm and about 83% of the annual rainfall falls during June to September. Waluj industrial area is one of the fastest developed industrial sectors. This growth has taken toll on the geological resources in the city and groundwater is primarily one such resource. With the surface water supply being no longer able to supply the needs of the city. Groundwater becomes the only alternate source of good quality water. But there are problems of ground water contamination in certain parts of the city, particularly in the industrial belts. Once the groundwater contaminated it may remain in unusable or oven hazardous condition for decades or even centuries. In general, the main cause of groundwater pollution is due to discharge of effluents which could be domestic, agricultural and industrial, or a combination of all these. Water is essential to all forms of life and makes up 50-97% of the weight of all plants and animals and about 70% of human body (Buchholz, 1998). Despite its importance, water is the most poorly managed resource in the world (Fakayode, 2005).The quality of water may be described according to its physico-chemical and micro-biological characteristics (N.S. Bhandari and Kapil Nayal, 2008). The quality of water is described by its physical and chemical characteristics. But if, some correlations were possible among these parameters then significant ones would be fairly useful to indicate the quality of water (Dhembare et.al., 1997).The studies on physico- chemical parameters of various water bodies have been performed in different countries (Habib et al., 1997). Water resources has been the most exploited natural system since man strode the earth water is an essential requirement for all biological systems (S.S. Patil &I.B.Ghorade 2013). “Water Quality” in term of ground water is generally used to express the physical, chemical or biological state of water. This is in turn, related to the suitability of water for particular use or purpose. The quality of water is characterized by a range of physical, chemical and biological parameters, which arise from a variety of natural and human influence. The contamination of ground water from the manmade and natural sources is causing a great threat to the ground water system. The increase in urbanization and industrialization are generating huge quality of waste and wastewater. The disposal of these waste and wastewater without proper treatment on unlined surface is finding its way to groundwater through percolation. The increase in use of chemical fertilizers, insecticide and pesticide in agricultural field has also contaminated the ground water (Handa, 1981).

Material and Methods

The present study was carried out from Waluj industrial area of Aurangabad District to evaluate the quality of the ground water. The aim of the study is to assess the impact of urbanization and industrialization and rapid growing developmental activities in the study area on the quality of ground water and to locate various sources and types of pollutants which are responsible for changes in ground water quality. To assess the ground water quality in Aurangabad region ten sampling stations (dug wells), which are scattered in the main areas of Waluj industrial area. The selected sites are of approximately 700 to 1000 m far from each other. The parameters used for the analysis of water are located in industrial areas, creating certain interference in the surface water and ground water. In addition to water quality. Analysis of the samples was carried out seasonally throughout the years from summer 2008 to winter 2009. Each parameter was analysed seasonally. In order to undertake accurate estimation of water quality, water analysis are done for the parameters like temperature, pH, electrical conductivity, alkalinity, nitrates, dissolved oxygen(DO),Biological Oxygen Demand (BOD),

Chemical Oxygen demand (COD).etc These analyses were carried out by referring the standard procedures according of APHA, AWWA, and WPCT, 1995, Trividy, and Goel (1986) and NEERI. The results are expressed as ppm or milligram per liter.

Result and Discussion

Temperature: In the present study the water temperature varied from 31.650C (well no 10) to 32.77 (well no 3) in summer season, from 24.120C (well no 3) to 25.920C (well no 6) in rainy season, and from 20.570C (well no 3) to 22.880C (well no 8) in winter. Basically the temperature is an important parameter because of its effects on the chemical and biological reactions on the organisms in water. (Kulkarni and Pawar, 2006). Speeding up of the chemical reactions in water, reduces the solubility of gases and amplifies then tastes and odours (Suryawanshi, et.al, 2004).

pH: In this study the pH values ranged from 7.06 (well no. 1) to 8.10 (well no. 2) in summer season, from 6.82 (well no 1) to 7.91 (well no 5) in rainy and from 6.08 (well no 10) to 7.96 (well no 2) in winter. pH is the measure of the acidity or alkalinity of water and measured in terms of hydrogen ion concentrations in water. The pH of the water sample indicates the neutral to alkaline nature which may be due to the pressure of bicarbonate which undergo hydrolysis in solution (Kulkarni and Pawar, 2006). The alkaline pH of the water samples indicates the presence of very weak basis salts (Mariappan, et.al, 2005). pH is very important in regulating the respiration and enzyme system. (Sivagurunathan and DhinaKaran, 2005).

Electrical Conductivity: The electrical conductivity (EC) vary from 193.2 (W3) to 439.95 mmhos/cm (W6) in summer, from 248.85 (W3) to 427.35 mmhos/cm (W6) in rainy and from 204.75 (W3) to 397.95 mmhos/cm (W6) in winter season. Electrical Conductivity is the capacity of a solution to conduct the electric current since most of the salts present in ionic forms are therefore capable of conducting current. A sudden increase in conductivity of the water is the indicator of the addition of the pollutant to the water (Trivedy and Goel, 1986). The high values of EC indicated that the potential stressors (domestic and industrial waste waters) in their locations could have actual influence on the water quality of wells in the study area (Murugesan and Kanna, 2007).

Alkalinity: The total alkalinity in the study area varied from 135.68 (W10) to 194.05 mg/l (W7) in summer, from 105.88 (W10) to 208.05 mg/l (W3) in rainy and from 112.61 (W10) to 181.95 mg/l (W 5) in winter season. The WHO acceptable limit for total alkalinity is 200 mg/l, beyond this limit taste may become unpleasant. Organically polluted water may also have alkalinity derived from the salts of organic weak acids like acetic acids, propionic acids and hydrosulphuric acid. Ammonia and hydroxides are also important sources of alkalinity in certain conditions (Swayer and MCkarty, 1985).

Nitrates: The nitrate content varied from 3.44 (W7) to 33.75 mg/l (W2) in summer, from 2.53 (W7) to 30.4 mg/l (W2) in rainy and from 2.99 (W3) to 28.72 mg/l (W2) in winter season. The average concentration of nitrate varies from 2.99±0.18 mg/l (W3) to 28.72±2.45 mg/l(W2). It is interesting to note that the maximum concentration was observed during the summer in well number 2 i.e. up to 33.75±0.54 mg/l. This can be attributed that this wells is located to down gradient direction of the effluent carrying stream (finley, 1990; Rafeeq and Khan, 2002).

Dissolved Oxygen (DO): The dissolved oxygen (DO) value in the study area varied from 6.87mg/l (W3) to 7.18 mg/l (W2 & W9) in summer, from 7.19 (W1) to 7.51 mg/l (W6) in rainy and from 7.3 (W6) to 7.54 mg/l (W7) in winter season. Dissolved oxygen is one of the most important indicator parameter for assessing pollution strength which influences an aquatic ecosystem. The dissolved oxygen level in natural water depends on physical, chemical and biological activities of the water body (Mohammad Musaddia and Anil Fokmare, 2002). DO is inversely proportional with temperature and hence in summer decrease in DO may be due to high temperature and low solubility of oxygen in water, consequently affecting BOD (Singh, et.al., 1991).

Biological Oxygen Demand (BOD): The BOD values varied from 6.12 mg/l (W8) to 12.97 mg/l (W3) in summer, from 4.64 mg/l (W5) to 5.82 mg/l (W7) in rainy and from 3.97 (W8) to 4.98 mg/l (W7 & W9) in winter season. Overall the BOD values are beyond the permissible limit stated by ISI (1983) as a 2.0 mg/l, in all the seasons. Measuring the amount of oxygen needed for microorganisms present in waste water to convert organic matter to inorganic matter is measured as amount of oxygen consumed in lab test over a period of 5 days at 200C. Tolerance limit of BOD for industrial effluents discharged into inland surface waters is 30 ppm (Verghese, et,al., 2006)

Chemical Oxygen Demand (COD): The variations in the COD values during the study period was varied from 20.97 (W5) to 26.64 mg/l (W2) in summer, from 18.0 (W5) to 22.54 mg/l (W2) in rainy and from 26.45 (W6) to 31.63 mg/l (W2) in winter season. Chemical oxygen demand (COD) measures the equivalent of that portion of the organic matter in a sample that is susceptible to oxidation by a strong chemical oxidant and is an important parameter for stream and industrial waste water studies. It is the measure of oxygen required to oxidize the organic and inorganic matter present in water by means of chemical reaction. (Swayer and Mccarty, 1985).

Table 1:-Seasonal variation of Physicochmical Parameters of the Ground water from the waluj Industrial area (2008-2009).

WellNo.	Temperature			Ph			E. Conductivity			Alkalinity		
	S	R	W	S	R	W	S	R	W	S	R	W
1	31.95	25.55	21.88	7.06	6.82	6.93	380.1	333.9	294.21	187.05	192.04	160.4
2	32.65	25.64	21.85	8.10	7.67	7.96	302.4	265.65	257.48	170.4	190.6	144.6
3	32.77	24.12	20.57	8.0	7.71	7.89	193.2	248.85	204.75	190.05	208.05	154.1
4	32.14	25.41	22.58	7.14	7.06	6.85	326.55	407.4	351.75	180.04	196.04	150.0
5	32.34	25.43	21.22	8.0	7.91	7.73	256.2	304.5	201.6	182.05	194.04	181.9
6	32.36	25.92	22.27	7.21	7.07	6.85	439.95	427.35	397.95	183.05	188.05	181.3
7	32.14	24.93	20.98	8.03	7.87	7.65	283.5	333.9	254.1	194.05	198.05	180.1
8	32.45	25.37	22.88	7.26	6.83	6.95	378.1	298.2	264.6	188.04	198.04	180.0
9	31.75	25.13	20.91	7.5	7.76	7.88	362.25	331.62	344.29	157.73	133.55	137.7
10	31.65	25.13	22.45	7.27	6.93	6.08	337.31	301.87	286.3	135.68	105.88	112.6

Table 2:-Seasonal variation of Physicochmical Parameters of the Ground water from the waluj Industrial area (2008-2009).

WellNo.	Nitrate			Dissolve Oxygen			BOD			COD		
	S	R	W	S	R	W	S	R	W	S	R	W
1	18.14	13.8	15.94	7.02	7.19	7.47	12.12	5.1	4.10	23.25	19.95	28.84
2	33.75	30.4	28.72	7.18	7.32	7.38	11.46	5.3	3.97	26.64	22.54	31.63
3	4.25	3.81	2.99	6.87	7.27	7.48	12.97	5.8	4.8	23.95	21.87	28.73
4	10.65	8.99	7.82	7.16	7.5	7.44	9.12	5.6	4.85	21.25	20.14	26.87
5	4.82	4.19	3.84	6.96	7.48	7.32	10.12	4.64	4.45	20.97	18.00	27.25
6	12.88	11.1	9.15	7.15	7.51	7.3	9.74	4.99	4.15	21.56	19.25	26.45
7	3.44	2.53	3.23	7.13	7.42	7.54	9.65	5.82	4.98	23.15	19.54	28.23
8	24.28	20.5	22.16	6.97	7.37	7.47	6.12	5.11	4.95	23.66	20.36	29.84
9	12.36	9.17	7.51	7.18	7.43	7.47	7.65	5.35	4.98	22.44	18.36	27.25
10	16.87	13.7	15.87	7.12	7.35	7.52	8.91	4.68	4.23	22.66	20.73	29.15

S=Summer. R= Rainy. W=Winter

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