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Physico-Chemical Assessment of Groundwater Quality of Ahmednagar Industrial Area

KEYWORDS: Physicochemical Assessment, Groundwater, Effluent and Wells

Patil S.S	Gandhe H.D	Ghorade I.B
Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad -431004. M.S. (India)	Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad -431004. M.S. (India)	Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad -431004. M.S. (India)

ABSTRACT *A systematic study has been carried out to assess the physicochemical characteristics of water samples of Wells from Ahmednagar Industrial area. 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 Ahmednagar Industrial area is deteoriated possibly due to increased of human activities and improper release of industrial effluents.*

Introduction:
Major sources of water pollution are sub standard quality sewage discharge, industrial pollution and runoff from agriculture land. At many a situations it is observed that there are no proper and adequate sewage treatment and disposal facilities generating from the urban population.

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. The quality of water may be described according to its physicochemical 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 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 Ahmednagar industrial area 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 Ahmednagar region ten sampling stations (dug wells), which are scattered in the main areas of Ahmednagar industrial area. The selected sites are of approximately 500 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 2010 to winter 2011. 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 during the study period i.e. from 2010-2011the water temperature of the well water was higher in summer and lower in winter seasons. In the study period it was high in well number (3) 32.15^0C ±0.56 in summer and lower in well number (9) 19.89^0C± 0.56 in winter season. In Rainy season during the study period for the years the water temperature was moderate. From the detailed study of the ground water of study area it is observed that the spatial and temporal variation of temperature is not much. The little higher temperature in pre monsoon season is recorded, because of the summer season. 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 the year 2010-11 it ranged 6.15 ± 0.89 (well no. 10) to 7.98 ± 0.58 (well no.2). The slight increase of pH can be attributed to discontinued supply of CO_2 due to cessation of rain fed charge of the aquifer (Deshmukh and Pawar, 2000). 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)

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varied from 183.2 ± 32.33 (W3) to 449.95 ± 45.56 mmhos/cm (W6) in summer, from 258.85 ± 17.88 mmhos/cm (W3) to 457.4 ± 15.89 mmhos/cm (W4) in rainy season and from 264.1 ± 21.34 (W7) to 387.95 ± 14.35 mmhos/cm (W6) in winter season. The low values of EC observed in the study area may be due to lower temperature and stabilization of water due to sedimentation (Parvateesam and Gupta, 1994; Pejaver *et.al*,. 2002). 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 150.04±3.65 mg/l (W4) to 195.68±4.75 mg/l (W10) in summer, from 148.05±2.69 (W6) to 258.05± 2.64 mg/l (W3) in rainy and from 132.61±2.87 (W10) to 191.95±3.78 mg/l (W5) in winter season. The high alkalinity of water in the present study may be due to the carbonates and bicarbonates (Nayak *et,al.*, 1982). 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 4.82± 0.23 (W5) to 39.75±0.80 mg/l (W2) in summer, from 2.58± 0.44 (W7) to 39.4±1.34 mg/l (W2) in rainy and from 2.8± 0.19 (W3) to 29.72±2.48 mg/l (W2) in winter season. Kasturi., *et. al*. (2005) stated that the major contribution to nitrate concentration is given by biological oxidation of organic nitrogenous substances from sewage and industrial wastes and the higher concentration of nitrogen may be due to the scanty flow of water and percolation of water. The lower values of nitrate in some of the sampling wells in the study area may be due to relatively stable thermal stratification and incomplete circulation of water (Suresh *et.al.*, 1992).

Dissolved Oxygen (DO): The dissolved oxygen (DO) value in the study area varied from 6.52 mg/l (W3) to 7.89 mg/l (W2) in summer, from 7.12 mg/l (W4) to 7.89 mg/l (W5) in rainy and from 7.19 mg/l (W9) to 7.89 mg/l (W8) in winter season. The minimum level of dissolved oxygen required for fresh water is 5.0mg/lit. It is well known fact that the oxygen balance of water is tagged with chemical oxidation on one hand the prevailing physic-chemical condition on the other (Mazher Sultana and Dawood Sharif, 2004). 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 6.89 (W9) to 13.46 mg/l (W2) in summer, from 4.22 mg/l (W10) to 6.56 mg/l (W1) in rainy and from 3.91 mg/l (W2) to 5.69 mg/l (W4) in winter season. The BOD values in the present study reveals that all the sample waters at all the sites ranging from 3.59 to 14.69 mg/l in all the samples values of BOD are beyond permissible limits. The maximum limit of BOD is 2.0 mg/l as stated by ISI (1983). This clearly indicates that the water sources are getting more polluted which are close to dumping sites. 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 20^0C. 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 22.27 (W4) to 26.89 mg/l (W9) in summer, from 19.00 (W5) to 23.25 mg/l (W6) in rainy and from 25.45 (W6) to 30.56 mg/l (W2) in winter season. The high value of COD was obtained in nearest wells at most of the sampling sites indicating contamination of well water with relatively oxidizable organic matter. The leachate generated due to dumping up of wastes from the industries might have percolated the waste water through the soil and combined with ground water. 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 study area (2010-2011).

Well-No.	Temperature			Ph			E. Conductivity			Alkalinity		
	S	R	W	S	R	W	S	R	W	S	R	W
1	31.59	24.58	21.56	6.78	6.94	6.79	390.1	343.9	284.21	157.05	182.04	170.4
2	31.88	24.19	21.19	7.69	7.98	7.78	392.4	275.65	287.48	190.4	190.6	154.6
3	32.15	23.97	20.56	7.79	7.92	7.76	183.2	258.85	264.75	180.05	258.05	164.05
4	31.89	23.73	21.89	7.19	6.90	6.56	366.55	457.4	341.75	150.04	166.04	160.04
5	31.90	23.59	20.58	7.93	7.88	7.68	276.2	354.5	301.62	162.05	194.04	191.95
6	31.80	25.56	21.89	7.17	6.89	6.23	449.95	457.35	387.95	153.05	148.05	171.3
7	31.40	23.88	20.77	7.88	7.68	7.91	293.5	343.9	264.1	194.05	198.05	190.05
8	31.91	24.89	22.79	6.85	6.98	7.12	388.1	288.2	294.6	168.04	198.04	190.04
9	31.19	24.56	19.89	7.78	7.95	7.39	382.25	341.62	384.29	177.73	183.55	157.67
10	31.18	24.59	22.56	6.95	6.15	6.78	357.31	351.87	266.3	195.68	155.88	132.61

S=Summer. R= Rainy. W=Winter

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Table 2:-Seasonal variation of Physicochmical Parameters of the Ground water from the study area (2010-2011).

Well-No.	Nitrate			Dissolve Oxygen			BOD			COD		
	S	R	W	S	R	W	S	R	W	S	R	W
1	16.14	15.77	16.94	7.56	7.22	7.65	12.59	6.56	5.29	25.25	20.95	27.15
2	39.75	39.4	29.72	7.89	7.36	7.56	13.46	4.92	4.23	25.66	21.58	30.56
3	8.25	3.61	2.98	6.52	7.56	7.49	11.26	5.56	5.6	24.99	22.89	29.73
4	16.65	8.69	7.70	7.32	7.12	7.36	10.19	5.61	5.69	22.27	22.14	27.87
5	4.82	4.29	3.89	6.26	7.89	7.46	9.13	4.89	4.33	22.99	19.00	26.25
6	19.88	11.3	9.19	7.49	7.56	7.23	9.56	5.12	4.56	23.58	23.25	25.45
7	6.44	2.58	3.25	7.79	7.53	7.59	10.88	6.16	5.12	24.25	20.54	29.23
8	22.28	20.9	22.19	6.26	7.49	7.89	7.59	5.89	5.15	23.56	21.33	29.15
9	12.36	9.19	7.59	7.32	7.57	7.19	6.89	5.56	3.91	26.89	19.30	28.36
10	18.87	13.69	16.89	7.49	7.49	7.36	9.89	4.44	5.56	25.28	21.75	29.19

S=Summer. R= Rainy. W=Winter

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