

Role of Major and Minor Constituents in Ground Water Quality of Industrial Area, Ahmednagar



Environmental Science

KEYWORDS : Dug wells, Major Constituents, Minor Constituents, Ground water quality & Effluent.

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ABSTRACT

Water pollution disturbs the normal uses of water for irrigation, agriculture, industries, public water supply and aquatic life. It is now considered not only in terms of public health but also in terms of conservation, aesthetics and preservation of natural beauty and resources. The groundwater composition in this particular case is likely to vary from place to place and time to time. Therefore, representative dug wells were selected for water samples collection. Some selected dug wells were close the effluent stream and some were progressively away from it. Thus dug wells in the study area were selected for their inventory and collection of water sample. The collected groundwater samples were brought to laboratory to carry out the chemical analysis of the constituents such as Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, TA, SO₄²⁻, PO₄²⁻, NO₃⁻ etc. The methods used for this analysis were standardized according to the procedure given in standard method or examination of water and wastewater by APHA-AWWA and WPCF (1975; Trividy and Goel, 1986;

Introduction:

Water is one of the most important compounds that profoundly influence the life. It is widely believed that life originated in some quiet corner of the primordial oceans in the remote part. Industrialization plays a very vital role in the process of development of any nation. However, unfortunately indiscriminate use of resources and raw materials in an unplanned manner and the lack of desire for a clean environment have resulted into industrial pollution and has threatened the very wellbeing of mankind and his environment. Water pollution disturbs the normal uses of water for irrigation, agriculture, industries, public water supply and aquatic life. It is now considered not only in terms of public health but also in terms of conservation, aesthetics and preservation of natural beauty and resources.

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. 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 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). 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. 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 present work was undertaken for the study of Impact of chemical industries on water quality of Ahmednagar industrial area of Ahmednagar district which include well inventory survey, geological and hydrological survey, sampling and collection of ground water for physico-chemical analysis

Material and Methods:

The water samples were collected for physico-chemical analysis from industrial area of Ahmednagar 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 grow-

ing 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 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 2009 to winter 2010. Each parameter was analysed seasonally. In order to undertake accurate estimation of water quality, The collected groundwater samples were brought to laboratory to carry out the chemical analysis of the constituents such as Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, TA, SO₄²⁻, PO₄²⁻, NO₃⁻ etc. The methods used for this analysis were standardized according to the procedure given in standard method or examination of water and wastewater by APHA-AWWA and WPCF (1975; Trividy and Goel, 1986.).

Table 1:- Average cationic, anionic, and minor constituents of ground water from study area (2009-2010).

Well No	Major Constituents				Anionic			Minor Constituents	
	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	TA	SO ₄ ²⁻	PO ₄ ²⁻	NO ₃ ⁻
1	546.15	4.86	551.33	145.33	210.34	188.77	224.20	1.10	20.48
2	664.65	4.98	1057.46	342.53	272.95	179.55	132.25	1.16	28.24
3	749.39	6.17	1090.4	221.03	369.78	175.04	139.08	1.25	7.74
4	428.92	4.93	1350.26	227.8	261.42	168.04	25.85	1.11	13.41
5	326.48	5.55	770.43	320.06	269.84	189.10	54.89	1.1	6.18
6	178.16	6.41	837.43	375.76	279.32	182.37	144.26	1.15	15.35
7	842.58	6.45	614.86	229.5	268.11	166.71	26.5	1.09	5.47
8	506.27	6.7	484.66	260.33	237.24	191.32	52.71	0.82	15.70
9	714.18	5.23	538.68	45.18	380.37	148.82	26.05	0.74	12.77
10	442.26	3.55	406.83	65.22	366.82	184.58	62.27	0.81	15.14

Note:1(TA is the total alkalinity 2) All values are in mg/l. 3) W= well number

Result & Discussion:**Major Constituents (Cationic):-**

Sodium: It is observed that the seasonal variations of sodium in the study area varied from season to season. Sodium concentration varied from 85.18 (W6) to 386.88 mg/l (W3) in summer, from 354.67 (W6) to 1879.8 mg/l (W7) in rainy and from 94.85 mg/l (W6) to 348.99 mg/l (W3) in winter season. The average value of the nitrate during the study period was ranged from 178.16 (W6) to 842.58 mg/l (W7). The excess sodium and chloride in drinking water may induce congestive heart failure (Brooker and Johnson, 1984); Sivagurunathan and Dhinakaran, 2005). Lower concentration is physiologically harmless (Goyal, *et al.*, 2006)

Potassium: The potassium in the ground water in the present study shows seasonal variation ranging from 3.89 (W10) to 8.62 mg/l (W7) in summer, from 2.58 (W4) to 3.91 mg/l (W3) in rainy and from 3.77 (W2) to 8.12 mg/l (W8) in winter season. The average value of the nitrate during the study period was ranged from 3.55 (W10) to 6.7 mg/l (W8). The concentration of potassium as per European directives are 12 mg/l, however, moderate quantities of it do not adversely affect the water quality (European Committee, 1976; Kiran *et al.*, 2006; Hassan *et al.*, 2013).

Calcium: It is observed from the study period that the seasonal variation ranging from 600.6 (W1) to 1284 mg/l (W6) in summer, from 218.4 (W2) to 749.8 mg/l (W4) in rainy and from 455.8 (W8) to 1429 mg/l (W2) in winter season. The average value of the nitrate during the study period was ranged from 406.83 (W10) to 1350.26 mg/l (W4). Calcium in excess may increase the total hardness of water preventing lather with soap and increases the boiling point of water (Rahul Mohan *et al.*, 2000) which induces acidosis as the cation is not readily absorbed and excess calcium ion enters the blood and displaces the plasma bicarbonate resulting non-clotting of blood (Lohani, 2005).

Magnesium: The Magnesium in the ground water in the present study shows seasonal variation ranging from 12.97 (W10) to 461.3 mg/l (W5) in summer, from 53.03 (W9) to 261.5 mg/l (W6) in rainy and from 26.38 (W9) to 497.6 mg/l (W6) in winter season. The average value of the nitrate during the study period was ranged from 145.33 (W1) to 375.76 mg/l (W6). After calcium magnesium is the most important alkaline earth metals present in the ground water. It is one of the most important contributors to the hardness of water.

Major Constituents (Anionic):-

Chloride: The chloride concentration in the water varied from the range of 225.24 (W7) to 497.63 mg/l (W9) in summer, from 181.31 (W1) to 366.43 mg/l (W5) in rainy and from 194.53 (W1) to 391.76 mg/l (W3) in winter season. The average value of the nitrate during the study period was ranged from 210.34 (W1) to 380.37 mg/l (W9). Chloride is a major anion in waste water. The chloride concentration is higher in organic wastes and its higher level in natural water is a definite indication of water pollution from organic wastes. However, there is no any apparent source of chloride in natural waters (Karanth, 1989). A number of workers (Kodarkar *et al.*, 1995; Chandrashekar, S.V.A. and M.S. Kodarkar 1994;) have reported chloride in water was to domestic wastes. The significance of chloride lies in its potential to regulate salinity of water and exerts consequent osmotic stress on aquatic community.

Total Alkalinity (TA): The total alkalinity in the study area varied from 147.6 (W8) to 199.04 mg/l (W1) in summer, from 98.89 (W9) to 236.24 mg/l (W8) in rainy and from 156.04 (W3) to 193.04 mg/l (W5) in winter season. The average value of the nitrate during the study period was ranged from 148.82 (W9) to 191.32 mg/l (W8). Alkalinity of water measures its capacity to neutralize acid salts of weak acids usually impart the natural alkalinity in waters (Goel, 1997). The constituents of alkalinity in natural system mainly include carbonate, bicarbonate and hydroxide. The WHO acceptable limit for total alkalinity is 200 mg/l, beyond this limit taste may become unpleasant.

Sulphate: The seasonal variations of sulphate (in mg/l) in the study area vary from 24.06 (W4) to 227.29 (W1) in summer, from 28.86 (W4) to 221.68 (W1) in rainy and from 18.84 (W9) to 223.65 (W1) in winter season. The average value of the nitrate during the study period was ranged from 25.85 (W4) to 224.20 mg/l (W1). Sulphate is found in appreciable quantity in all natural waters, particularly in arid and semiarid regions where natural water in general have high salt content (Saxena, 1989). Sulphate itself has never been a limiting factor for water bodies as it dissolves in water easily while flowing with running water. In normal level, sulphate is more than enough to meet plants need. If the concentration exceeds, above 500 mg/l it has laxative effect and cause gastro intestinal irritation (Hassan *et al.*, 2013).

Minor Constituents:-

Phosphate: The seasonal variations of phosphate in the study area vary from 0.69 (W9) to 1.95 (W3) in summer, from 0.76 (W9) to 0.99 (W10) in rainy and from 0.49 (W10) to 0.99 (W7) in winter season. The average value of the nitrate during the study period was ranged from 0.74 (W9) to 1.25 mg/l (W3). Low values of phosphate observed in the study area may be due to the fact that as tropical water always possess low concentration of phosphate (Dasgupta and Purohit, 2001). High concentration of phosphate leads to increase in the growth of algae and eutrophication. The permissible limit of USPHS is 0.1 mg/l. The excess, causes risk to human beings as algae produces toxins, which damage neurological system (Kalaivani, *et al.*, 2006).

Nitrates: The nitrate content varied from 6.52 (W5) to 30.88 mg/l (W1) in summer, from 2.13 (W8) to 29.48 mg/l (W2) in rainy and from 3.97 (W7) to 29.48 mg/l (W2) in winter season. The average value of the nitrate during the study period was ranged from 5.47 (W7) to 28.24 mg/l (W2). Besides the above, the regeneration of nitrates from sediment to surface water also plays an important role for higher values. The nitrate depletion is induced by denitrification process initiated by the denitrifying bacteria in the absence of D O (Banakar, *et al.*, 2005).

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