RESEARCH PAPER | Environment | Volume : 3 | Issue : 5 | May 2013 | ISSN - 2249-555X

# Role of Major and Minor Constituents in Ground Water Quality of Industrial Area, Aurangabad. M.s. India.

KEYWORDS: Major Constituents, Minor Constituents, Ground water quality & Effluentt


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**ABSTRACT** *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 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.

Waluj industrial area is one of the fastest developed industrial sectors. 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 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.

**Material and Methods**

The water samples were collected for physico-chemical analysis 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 2010 to winter 2011. 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+, $Ca^{2+}$, $Mg^{2+}$, Cl-, TA, $SO_4^{2-}$, $PO_4^{2-}$ $NO_3^-$ 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.) The results are expressed as mg/l.

**Table 1:- Average cationic, anionic, and minor constituents of ground water from study area (2010-2011).**

| Well No | Major Constituents | | | | | | | Minor Constituents | |
|---|---|---|---|---|---|---|---|---|---|
| | Cationic | | | | Anionic | | | | |
| | $Na^+$ | $K^+$ | $Ca^{2+}$ | $Mg^{2+}$ | $Cl^-$ | TA | $SO_4^{2-}$ | $PO_4^{2-}$ | $NO_3^-$ |
| 1 | 443.27 | 3.26 | 448.65 | 125.1 | 257.35 | 187.78 | 214.59 | 0.96 | 15.63 |
| 2 | 485.58 | 4.15 | 1206.9 | 331.5 | 251.01 | 186.11 | 119.75 | 1.10 | 30.33 |
| 3 | 687.66 | 4.28 | 930.67 | 214.2 | 269.22 | 193.17 | 115.46 | 1.19 | 3.61 |
| 4 | 342.99 | 3.36 | 931.74 | 226.63 | 244.66 | 200.05 | 22.97 | 0.8 | 8.97 |
| 5 | 232.27 | 4.61 | 602.68 | 212.1 | 254.59 | 187.04 | 33.09 | 0.69 | 4.19 |
| 6 | 159.7 | 4.98 | 653.35 | 260.12 | 242.32 | 189.78 | 115.0 | 0.95 | 10.82 |
| 7 | 521.49 | 6.42 | 525.21 | 186.6 | 255.62 | 189.78 | 115.0 | 0.75 | 3.00 |
| 8 | 431.32 | 5.94 | 394.1 | 200.6 | 208.84 | 163.04 | 46.617 | 0.68 | 21.86 |
| 9 | 468.85 | 5.06 | 472.32 | 46.3 | 354.37 | 140.27 | 20.4 | 0.6 | 9.21 |
| 10 | 387.44 | 3.32 | 354.44 | 88.07 | 297.54 | 115.52 | 41.29 | 0.44 | 15.57 |

**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 79.66 (W6) to 307.87 mg/l (W3) in summer, from 313.77 (W6) to 1465.85 mg/l (W3) in rainy and from 85.67 mg/l (W5) to 313.49 mg/l (W7) in winter season. The average value of the nitrate during the study period was ranged from 159.7 (W6) to 687.66 mg/l (W3). 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

Volume : 3 | Issue : 5 | May 2013 | ISSN - 2249-555X

study shows seasonal variation ranging from 3.12 (W10) to 8.68 mg/l (W7) in summer, from 2.11 (W4) to 4.17 mg/l (W8) in rainy and from 3.11 (W4) to 7.63 mg/l (W7) in winter season. The average value of the nitrate during the study period was ranged from 3.26 (W1) **to** 6.42 mg/l (W7).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).

**Calcium:** It is observed from the study period that the seasonal variation ranging from 455.52 (W1) to 1345 mg/l (W3) in summer, from 243.83 (W10) to1166 mg/l (W2) in rainy and from 342.87 (W10) to 1209.87 mg/l (W2) in winter season. The average value of the nitrate during the study period was ranged from 354.44 (W10) to 1206.9 mg/l (W2). 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 nonclotting of blood (Lohani, 2005).

**Magnesium:** The Magnesium in the ground water in the present study shows seasonal variation ranging from 50.11 (W9) to 388.4 mg/l (W6) in summer, from 45.58 (W9) to 318.6 mg/l (W2) in rainy and from 43.21(W9) to 341.1 mg/l (W2) in winter season. The average value of the nitrate during the study period was ranged from 46.3 (W9) to 331.5 mg/l (W2). 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 218.58 (W8) to 478.27 mg/l (W9) in summer, from 205.11 (W8) to 339.87 mg/l (W9) in rainy and from 202.83 (W8) to 254.66 mg/l (W3) in winter season. The average value of the nitrate during the study period was ranged from 208.84 (W8) to 354.37 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; Chandrashekhar, 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.

**Alkalinity (AT):** The total alkalinity in the study area varied from 132.77 (W10) to 190.05 mg/l (W1) in summer, from 103.57 (W10) to 215.05 mg/l (W4) in rainy and from 107.04 (W8) to 198.05 mg/l (W4) in winter season. The average value of the nirate during the study period was ranged from 115.52 (W10) to 200.05 mg/l (W4).

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 22.03 (W9) to 216.58 (W1) in summer, from 19.49 (W9) to 214.68 (W1) in rainy and from 19.68 (W9) to 212.50 (W1) in winter season. The average value of the nitrate during the study period was ranged from 20.4 (W 9) to 214.59 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.

**Minor Constituents:-**
**Phosphate:**
The seasonal variations of phosphate in the study area vary from 0.66 (W10) to 1.79 (W3) in summer, from 0.28 (W10) to 0.83 (W3) in rainy and from 0.39 (W10) to 0.98 (W2) in winter season. The average value of the nitrate during the study period was ranged from 0.44 (W10) to 1.19 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 3.37 (W7) to 33.06 mg/l (W2) in summer, from 2.47 (W7) to 29.79 mg/l (W2) in rainy and from 2.93 (W3) to 28.14 mg/l (W2) in winter season. The average value of the nitrate during the study period was ranged from 3.00 (W7) to 30.33 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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