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PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER QUALITY IN KOUNDAMPALAYAM PANCHAYAT, COIMBATORE DISTRICT, TAMILNADU-INDIA

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Abstract

Present work was undertaken to analyse the physical and chemical characteristics of the drinking water in the selected areas of Kavundampalayam Panchayat in Coimbatore. 15 bore wells having different depth were selected for analysis (three zones with five stations each). Over all analysis explains that all the parameters showed higher values at II zone compared to other zones. Some of the parameters were found to be higher than the prescribed limits while other parameters were lower than the limits. No marked relationships were recorded among the parameters. The water quality of these zones will be degrading much in future. The major factors of the water quality deterioration appeared to be the lack of proper sanitation and protection of drinking water bodies.

Key Words: Ground water, Physico-chemical parameters

Introduction

Water is the most essential commodity for human consumption and it is one of the renewable resources which must be prevented from deterioration in quality (Gadi *et al*., 2003). Groundwater is one of the earth's renewable resources which occur as a part of hydrological cycle (Metha and Trivedi, 1990). The industrial pollutants associated with organic matter, inorganic dissolved solids and other unwanted chemicals caused serious ground water problems (Poonamtyagi *et al*., 2000; Murugan *et al.,* 2007). Chemicals and toxic elements are being let into the drains, streams and even open spaces adjoining the industrial areas without any check (Avasan maruthi *et al*., 2004).

The scarcity of drinking water has forced the population to use whatever the quality of water available in the region. This has seriously affected human health (Agarkar and Thombre, 2005). Determination of physico-chemical characteristics of water is essential for assessing the suitability of water for various purposes like drinking and domestic uses. Quality of ground water is declining due to heavy industrialization, indiscriminate disposal of industrial wastes both on land and surface water channels and human activities (Chaudhary *et al.,* 2005; Sati and Patwal, 2008). Accoding to WHO about 30% of all the diseases of human beings are caused by water, therefore, water that is supplied for drinking and various other purposes must be of good quality (Venkata Subramani *et al.,* 2006)

The Coimbatore is the third largest city in Tamilnadu and it is also proudly called as Manchester of South India for its immense growth of industrialization and urbanization. The chemical industries, textile mills and various factories located in different areas in the city have been dumping their waste materials in the ground. The students should be well aware about impact of drinking water quality on health and ultimately educational progress. Based on the above views, the present study has been undertaken to monitor the qualities of groundwater at various locations of Kavundampalayam panchayat in Coimbatore.

Materials and Methods

For the present study, 15 bore wells from different places of Koundampalayam panchayat in Coimbatore were selected. The places were Indira Nagar, Meenakshi Nagar, Balan Nagar, Vinayakar Temple, Anna Nagar, Subammal Layout, P&T Colony, N.K.Nagar, Saravana Nagar, Poombukar Nagar, Simson Nagar, Ediyarpalayam, Devanga Nagar, Gandhi Nagar and Aiswarya Garden. The places were grouped into 3 zones with 5 places each (Fig : 1). The water samples were collected and analysed in between Septemper- 2005 and February-2006.

Samples were collected in clean plastic cans and the samples were brought immediately to the

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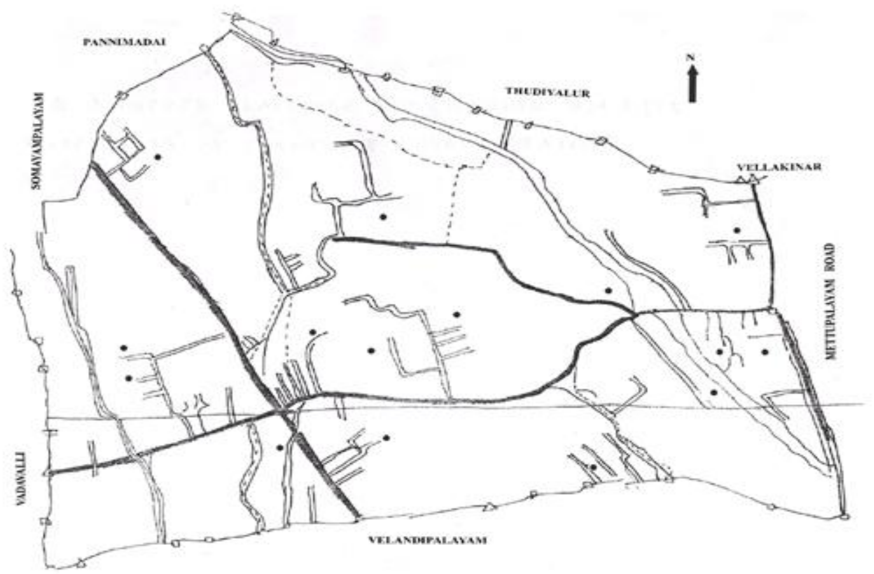
laboratory and kept in the refrigerator for further analysis. The collected samples were preserved for the determination of dissolved oxygen content by adding 1 ml of manganous sulphate and 1 ml of alkaline iodide per litre (Anon, 1965). The samples were analyzed for temperature, total solids, pH (Elico pH meter model No.L-11), dissolved oxygen, dissolved carbondioxide (Lind, 1974), calcium and magnesium (Jhingran *et al*., 1969), chloride (Jackson, 1973), Sulphate (Michael, 1984), nitrate (Strickland and Parsons, 1965), alkalinity (Piper, 1950) (carbonate and bicarbonate), phosphate, silicate (Jhingran *et al*., 1969) and iron (Strickland and Parsons, 1965).

Figure 1. Map showing the sampling stations at Kavundampalayam Panchayat in Coimbatore, India



Results and Discussion

For the present study, the ground waters collected from fifteen places were analysed for physical and chemical characteristics. The physical and chemical characters analysed in each zone are given in the Table 1.

Temperature

The minimum value was found to be 25.6°C at zone III, whereas the maximum value 26.6°C was noted at zone II. The intermediate value 26.4°C was observed at zone I. A little indirect relationship was observed among the parameters temperature, oxygen and carbondioxide. The fluctuation may be due to the type and concentration of polluted matter in the water as pointed out by Brown et al. (1967). All the values were within the permissible limits.

Total solids

The minimum values were found to be 940 mg/l at zone III, whereas the maximum value 1550 mg/l was noted at zone II and it was above the prescribed limits of ISI and WHO. The values were observed as 1070 mg/l at zone I. The concentrations of total solids in all the three zones were within the permissible limit (1500mg/l) of ISI (1991) and WHO (1996) standards. However, the high total dissolved solids found in the zone II may be due to the breakage of taps, improper purification of water, dust particles from the pipelines and addition of chloride as stated by Pandian et al.(2005).

pH.

At zone I, the pH was slightly alkaline (7.2) whereas in zone II and III the values were found to be almost equal (7.0). The pH has no direct adverse effect on health, but at the same time alters the taste of water. Higher pH reduces the germinal potentiality of chlorine and induces the formation of toxic trihalo methanes (Trivedy and Goel, 1986). In the present study, the pH values showed almost neutral condition in all the three zones as observed by Kataria, (2000).

Table 1: The physical and chemical characteristics of water in zones-i, ii and iii.

Parameters	Zone-I	Zone-II	Zone-III
Temperature	26.4°C ± 1.09	26.6°C ± 2.30	25.6°C± 1.51
Total solids	1070 ± 343.87	1550 ± 594.76	940 ± 400.62
pH	7.2 ± 0.40	7.0 ± 0.41	7.0 ± 0.2
Dissolved O_2	4.41 ± 0.86	3.9 ± 0.80	3.6 ± 0.54
Dissolved CO_2	1.4 ± 0.68	0.88 ± 0.15	0.88± 0.15
Calcium	339.6 ± 139.64	324.0 ± 125.57	276.0 ± 93.83
Magnesium	300 ±130.52	376 ±0.155	237 ±139.35
Chloride	391.9 ± 230.03	484.2 ± 221.66	279.7 ± 157.13
Sulphate	31.3 ±12.45	33.3 ±11.93	21.3 ±10.28
Nitrate	10.3 ± 11.54	13.1 ± 11.69	21.5 ± 28.62
Carbonate	8.0 ± -3.57	Nil ± 0	8.0 ± 0
Bicarbonate	42.0 ± 10.77	47.4 ± 5.07	42.4 ± 10.80
Phosphate	5.2 ± 0.95	4.7 ± 0.48	4.6 ± 0.59
Silicate	0.6 ± 0.89	1.5 ± 0.89	1.0 ± 0.44
Iron	1.0 ± 0.44	1.0 ± 0.44	1.0 ± 0.44

All the values are in mg/l except temperature and pH.

Dissolved Oxygen

The minimum value 3.6 mg/l of oxygen was observed at zone III, whereas the maximum value (4.4 mg/l) was noted at zone I. The value was found to be 3.9 mg/l at zone II. All the values were within the permissible limits. The dissolved oxygen level reflects water quality (Kataria, 2000). In the present study, the oxygen level was found to be within the permissible limits of WHO, (1984). In the zone III, the oxygen content was less than the limits. Sakul and Chaudhuri, (1999) reported the low level of dissolved oxygen due to the presence of non-gas forming bacteria. A slight direct relationship was noted between pH and oxygen.

Dissolved Carbondioxide

At zone I, the dissolved carbondioxide was higher (1.4 mg/l) compared to other zones. In zone II and III, the values were found to be almost equal 0.88 mg/l and 0.88 mg/l respectively. The carbondioxide in water indicates the presence of decomposable organic matter. Bacterial action on organic matter releases Co2 gas. Normally surface waters contain less than 10mg/l of Co2. In the present study, all the three zones showed quite less content of carbondioxide as noted by Paul and Misra, (2004).

Calcium

The calcium content of samples ranged from 276.0 to 339.6 mg/l. The minimum value was found to be 276.0 mg/l at zone III, whereas the maximum values 339.6 mg/l and 324.0 mg/l were observed in zones I and II respectively. The values were above the permissible limits. According to Pawar and Pulle, (2005) calcium is one of the alkaline earth metal and is known to indicate or produce any hazardous effect on human health. A direct relationship was observed between calcium and magnesium.

Magnesium

The magnesium level was found to be highest in all zones and it crossed the prescribed levels. The minimum 237 mg/l of magnesium was observed at zone III, whereas the maximum value of 376 mg/l was noted at zone II. The value was found to be 300 mg/l at zone I.

Total hardness, calcium hardness and magnesium hardness were found to be high above the permissible limit. Similar observations were recorded by Kataria, (2000). Hardness has no adverse effect on human health and water above hardness of 200mg/l may cause scale deposition in the water distribution system and more soap consumption. Soft water below hardness less than 100mg/l is more corrosive for water pipes (WHO, 1972).

Chloride

The minimum value 279.7 mg/l of chloride was observed at zone III, whereas the maximum value 484.2 mg/l was noted at zone II. The values were found to be higher in all the three zones beyond the permissible limits. No marked relationship was noticed among the parameters chloride, sulphate and nitrate. The chloride concentration is differentiated in ground water. Maximum permissible limit of chloride is 250mg/l (ICMR, 1975). In the present study, the chloride values were higher than the permissible limits in all the three zones. The maximum value may be the reason that the ground waters are probably getting their chloride content from septic tank effluents or seepage from channels running at some parts of the city or from garbage and solid waste dumps where the bore wells are located as pointed out by Shivakumar and Ramamoorthy, (1977).

Sulphate

The sulphate values were found to be less in all the three zones. The minimum value 21.3 mg/l was observed at zone III, whereas the maximum value 33.3 mg/l was noted at zone II. The intermediate value 31.3 mg/l was recorded at zone I. Sulphate is the common ion present in water. It can produce bitter taste at high concentrations. Sulphate originates from sedimentary rocks and igneous rocks (Mor et al., 2003). In the present study, the sulphate contents were quite below the permissible limits in all the three zones. This studies are coincided with the studies of Thirumathal and Sivakumar, (2003).

Nitrate

The maximum value 21.5 mg/l of nitrate was recorded at zone III, whereas the minimum 10.3 mg/l was noted at zone I. The value at zone II was found to be 13.3 mg/l. The nitrate contents of the three zones were only within the prescribed limits. Prasad and Ramesh chandra (1997) explained that the high nitrates were the indicative of high pollution load. Mason (1991) observed the increased levels of nitrates by intrusion of sewage and industrial effluents into the natural water.

Carbonate

The carbonate values in zone I and II were found to be almost equal and it was 8.0 mg/l. The nil value was recorded at zone II.

Bicarbonate

The values in zone I and zone III were found to be almost equal, 42.0 and 42.4 mg/l respectively. At zone II, the bicarbonate value was higher 47.4 mg/l compared to other zones.

Carbonate and bicarbonate contents contribute total alkalinity. Alkalinity alone is not harmful to human beings (Pande and Sharma, 1999). Excess alkalinity gives a bitter taste to water. In the present study, all the values obtained from three zones, were within permissible limits of pollution control board agencies and the values coincided with the observations of Balakrishnan and Karuppusamy (2005).

Phosphate

The values in zone II and zone III were found to be almost equal 4.7mg/l and 4.6 mg/l respectively. At zone I the phosphate value was higher 5.2 mg/l when compared to other zones. The presence of phosphorous in neutral water is almost solely as phosphates. Phosphorus is essential for the growth of the organisms and can be the nutrient that limits the primary productivity of body of water (Rao et al., 2004). In the present study, the phosphate level was found to be within the limits of WHO (1996) and other agencies. This shows the unpolluted nature of water as noted by Pandian et al. (2005).

Silicate

The silicate levels fluctuated as 0.6mg/l, 1.5 mg/l and 1.0 mg/l in zones I, II and III respectively. The maximum value was observed at zone II and minimum at zone I. The amount of silicate in the water body depends on the amount of biological activity occurring. In the present study, the silicate values were found to be well within the permissible limits. The values were in agreement with the studies of Gadi (2003).

Iron

The iron content was found to be similar in all the zones I, II and III. The value recorded was 1.0mg/l in all the three zones. Iron is biologically an important element. It is essential to all organisms and present in haemoglobin system. A stringent taste is detectable by some persons at levels above 1 mg/l (Rao et al., 2004). In the present study, the iron contents were slightly higher than the permissible limits in all the three zones. The high concentration may be due to dumping of wastes around the bore wells.

In the present study the concentrations of all the physical and chemical characteristics of the water samples collected from 3 zones were as per the standard limits prescribed by the various agencies. Some parameters like total solids, calcium, magnesium and chlorides crossed the standard limits.

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