Original Research Paper

Study of Well Waters in the Area Around Paper Mill Industry, Udumalpet, Tamilnadu

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ABSTRACT

Samples of well waters in the area around a paper mill industry situated at Udumalpet, Tamil Nadu were collected and analysed for physicochemical characteristics to assess the water quality during the period of six months of pre-monsoon season (June-November 2008). The data show that the quality of groundwater is grossly polluted and not suitable for drinking and irrigation purposes due to presence of high solids and electrical conductivity.

INTRODUCTION

The quality of groundwater is of great importance to people as it is a prime source of water for irrigation and other uses. All groundwaters, irrespective of their source of origin, contain mineral salts depending upon geological and environmental factors. Since, these factors are varying from place to place, the groundwaters of any region are characterized by marked difference in their chemical properties. Groundwater is part of hydrological cycle and 50% of the world's population depends on groundwater for their drinking purposes. An important aspect of urbanization is the increase in demand and creation of potential with the possibility of pollution of groundwater (Dong et al. 1988).

The present investigation was undertaken with a view to study the quality of groundwater for drinking and irrigation in and around a paper mill industry located near Udumalpet in Coimbatore district of Tamil Nadu.

MATERIALS AND METHODS

For the present study, four well water samples affected by the paper mill effluent were collected from four villages, namely Kuppampalayam, Andipatti, Aathur and Samathuvapuram. Out of the four well water samples, one sample is used for drinking purposes and the remaining three are used for irrigation. The four wells are 20-30 feet in depth. Water samples, collected from the four villages, were named as 'A', 'B', 'C' and 'D' respectively. Samples were collected during premonsoon and monsoon seasons and analysed using the standard methods (APHA 1998).

RESULTS AND DISCUSSION

The various physicochemical characteristics, determined for the paper mill effluent polluted groundwaters at the four sampling sites, are given in Tables 1, 2 and 3. The temperature varied from 28°C to 30°C in the well waters. Minimum temperature was recorded in monsoon, and maximum in the premonsoon months. The groundwater maintains fairly a constant temperature. Deep aquifers, however, have a higher temperature due to earth's thermal gradient.

The well waters were colourless throughout the study period. Suspended solids ranged from 1000 mg/L to1390 mg/L. Dissolved solids showed maximum of 2500 mg/L, and minimum of 950 mg/L. The dissolved solids are mainly consisted of bicarbonates, sulphates and chlorides of calcium, magnesium and sodium (Dinesh Kumar et al. 2004).

The value of electrical conductivity ranged from 4.2 to 7.0 mmhos/cm. The maximum electrical conductivity is during monsoon season which could be attributed to the percolation of runoff from agricultural and other areas (Aravind Kumar 1997). pH of the samples varied from 7.00 to 8.05. Maximum pH was noted in the sample 'B' during premonsoon season, and minimum in sample 'C' during monsoon season. The dissolved oxygen content was maximum in sample 'B' during premonsoon season, and minimum in sample 'C' during monsoon.

The carbon dioxide ranged between 34 mg/L and 45 mg/L with the highest level in premonsoon season in all the samples. The alkalinity varied from 110 mg/L to 165 mg/L. According to Kataria et al. (2004) higher alkalinity is due to leaching of carbonate and bicarbonate salts from soil during natural infiltration of water. Philipose (1959) suggested that a water body with alkalinity value higher than 100 mg/L is usually nutritionally rich.

Phosphate value was found to be maximum in sample 'D', and minimum in sample 'A'. The values ranged between 0.85 mg/L and 1.42 mg/L. Phosphate values were found to be maximum during monsoon season, which may be due to percolation of domestic sewage from nearby houses and animal waste (Sastry & Pratima 1998).

Table 1: Analysis of physical parameters in four well waters for a period of six months (June-Nov. 2008).

Season	Name of Samples	Tempe-rature	Colour	Suspended solids	Dissolved solids	Total solids	Electrical conductivity
Pre-monsoon	A	29	colourless	1000	950	1950	4.5
Monsoon		28	colourless	1325	1450	2775	5.2
Pre-monsoon	B	29	colourless	1100	1000	2110	4.0
Monsoon		28	colourless	1285	2500	3785	5.0
Pre-monsoon	C	30	colourless	600	650	1120	4.2
Monsoon		29	colourless	650	750	1400	4.5
Pre-monsoon	D	29	colourless	1300	1400	2700	6.3
Monsoon		28	colourless	1390	1500	2890	7.0

All values in (mg/L) except Temperature($°C$) and EC (mmho/cm).

Table 2: Analysis of chemical parameters in four well waters for a period of six months (June-Nov. 2008).

Seasons	Name of Samples	pH	Dissolved Oxygen	Free CO_2	Alkalinity
Pre-monsoon	A	8.04	9.0	36	110
Monsoon		8.00	7.2	34	115
Pre-monsoon	B	8.05	14.0	42	125
Monsoon		7.95	10.0	40	130
Pre-monsoon	C	7.58	6.0	39	150
Monsoon		7.00	5.0	36	165
Pre-monsoon	D	8.01	13.0	45	140
Monsoon		7.51	12.0	43	150

All values in mg/L except pH

Table 3: Analysis of chemical parameters in four well waters for a period of six months (June-Nov. 2008).

Seasons	Name of Samples	Phosphate	Nitrate	Silicate	Iron	Calcium	Magnesium	Chloride	Sulphate
Pre-monsoon	A	0.85	0.02	0.70	Bdl	70	27.00	50.00	0.65
Monsoon		0.98	0.04	0.72	Bdl	80	28.80	59.00	0.80
Pre-monsoon	B	1.00	0.03	0.75	Bdl	62	35.00	62.00	0.50
Monsoon		1.10	0.05	0.80	Bdl	88	38.40	65.00	0.82
Pre-monsoon	C	0.99	0.05	0.82	Bdl	78	30.00	65.00	0.70
Monsoon		1.02	0.06	0.85	Bdl	84	33.60	74.00	0.79
Pre-monsoon	D	1.20	0.07	0.88	Bdl	60	31.00	80.00	0.59
Monsoon		1.42	0.08	0.92	Bdl	72	36.00	82.00	0.90

All values are expressed in mg/L; Bdl - Below detection level

The nitrate ranged from 0.02 mg/L to 0.08 mg/L. The maximum value was recorded during monsoon season which may be due to the transport of nutrients from watershed areas with the run off water.

Maximum value of calcium and magnesium was reported in sample 'B' as 88 mg/L and 38.40 mg/L. Minimum value of these was found in samples 'D' and sample 'A' as 60 mg/L and 27 mg/L. Calcium and magnesium are primarily found in groundwater due to the weathering of limestone.

The chloride varied from 50 mg/L to 8.2 mg/L in sample 'A' and 'D'. Higher value of chloride is usually due to presence of soluble chloride from rocks. The sulphate ranged between 0.50 mg/L and 0.90 mg/L in samples 'B' and 'D'. It was found to be maximum in all the samples during monsoon season.

The study shows that the quality of well water from different areas in Udumalpet is affected by the paper mill as evidenced by higher values of many parameters. The sample 'C' is presently used for drinking purpose and the samples 'A', 'B' and 'D' are used for irrigation. It may be concluded from the study that all the four well water samples should be properly treated for use in drinking and irrigation purposes.

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