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Seasonable and Spatial Variation of Groundwater Contamination in and around Tannery Zones of Vaniyambadi, Vellore District, Tamil Nadu, South India

V.A. Vijaya Anandan[1], A. Thaminum Ansari[2]
[1] *Research and Development Centre, Bharathiar University at Coimbatore*- 641 046, *Tamil Nadu, India*
[3]*PG & Research Department of Chemistry, Muthurangam Government Arts College, Vellore 632002, Tamil Nadu, India*

Abstract: ***As groundwater contamination is one of the leading problems for agricultural and drinking commitments in Vellore district areas, groundwater assets, as a while in Vellore district are supportable but still regional, seasonal and spatial circulation is unbalanced. In two dissimilar seasons (post monsoon and pre monsoon) 7 groundwater samples were collected near tanneries in different villages in Vaniyambadi region, Vellore district. The groundwater contamination assessment has been carried out by estimating the heavy metals such as Zn, Ni, Cu, Cr, Pb, Al, and Cd. The seasonable variation of groundwater contamination is assessed and the results reveals that most of the samples are found to be not suitable for domestic and irrigation purposes and post monsoon water samples were more contaminated than pre monsoon water samples. Based on these parameters, groundwater has been evaluated in not suitable for drinking and irrigation purpose.***
Keywords: Groundwater, Vaniyambadi, Contamination, Vellore district.

I. INTRODUCTION

Water is a crucial and vital component for our life upkeep system. The rainfall is the major source for surface and groundwater resources and drought and floods are the extreme events of rainfall. The vagarious of monsoon and spatial variation in the hydro geological framework in the state make the water resources non-uniform in the state. Ground water is the major source of water supply for domestic, irrigation and industrial uses in Tamilnadu due to the ever increasing demand to satisfy the needs of a growing population and near - total utilization of available surface water resources [1]. Three fourths of the state is underlain by Achaean crystalline rocks, which form aquifers with limited groundwater prospects. The increasing extraction of ground water from these aquifers more than the recharge has caused over exploitation of groundwater resources in several parts of the state [2 – 4]. This has resulted in decline of groundwater levels and piezometric heads, drying up of shallow wells and decrease in the yields of wells. In addition, pollution of groundwater resources by agricultural practices and industrialization also pose a serious constraint in several parts of the state for its sustainable development and management. Water due to great solvent power, is constantly threatened to get polluted easily. Pollution in broad sense refers to any change which causes misbalance in the natural quality of the environment brought about through physical, chemical or biological processes [5 - 7]. There are approximately 117 well locations in the district. Storage of ground water is dependent on three factors viz Geology, Topography and Climate. Water level responds to monsoon and indicates a steady rise and fall. Water quality is studied based on the ground water samples collected from wells of the Vellore district. Vellore district is broadly classified into hilly terrains and plain regions. Generally sub–tropical climate prevails over the district. The normal average annual rainfall from four seasons is received [8 – 10]. Water quality is fluctuated due to large number of tannery units located in Vellore district. Therefore, it is essential to know the consequence of geographical creations and agricultural/industrial activities on groundwater chemistry. Groundwater quality is the main factor defining its appropriateness for consumption, domestic, farming and industrial commitments [11]. The suitability of groundwater for drinking and irrigation has been assessed in north and eastern part of Vellore district India. In two different season periods (post monsoon and pre monsoon) 7 groundwater samples were collected near tanneries in different villages in Vaniyambadi taluk, Vellore district. The groundwater quality assessment has been carried out by assessing the heavy metals such as Copper, Chromium, Lead, Zinc, Nickel, Aluminium, Cadmium. The seasonable variation of quality of the groundwater is assessed and the results reveals that most of the samples are found to be not suitable for domestic and irrigation purposes and post monsoon water samples were more contaminated than pre monsoon water samples. Based on these parameters, groundwater has been assessed in not favor of its suitability for drinking and irrigation purpose.

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II. MATERIAL AND METHODLOGY

The analytical p Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) were determined by EDTA titration method using Eriochrome Black-T (EBT) indicator and Ammonia Buffer. Sodium (Na), Potassium (K), Chromium (Cr^{3+}), Lead (Pb^{2+}), Iron (Fe^{2+}), Nickel (Ni), Zinc (Zn), Copper (Cu) and Manganese (Mn) were determined by spectrometric method using Flame Atomic absorption spectrophotometer (FAAS - VARIAN SPECTRA A-240). The results obtained were tabulated, evaluated and discussed in accordance with the standards prescribed under 'Indian standard drinking water specification IS 10500: 1992' of Bureau of Indian Standards [BIS] & WHO [9 – 12 & 13].

III. ABOUT STUDY AREA (VANIYAMBADI TALUK)

The study was carried out in Vaniyambadi taluk in the Palar river basin. The geographic location of the area is between 78042'0" East longitude and 12047'0" North latitude Figure.2. The area serves as a home town for lots of small scale and large scale tanning industries. Vaniyambadi taluk have 77 villages and almost many villages are having at least one tannery. The normal average rainfall of this basin is 953.4 mm.

Fig. 1 Geographical Map of Study area (Vaniyambadi – Vellore district)

The climate is tropical and highly humid. Major irrigated crops in this basin about thirty years ago are paddy, groundnut, pulses, sugarcane and banana. The reduction of agriculture activities in the ten villages are due to discharge of tannery effluent were studied carefully, field surveyed. 7 villages are selected randomly in Vaniyambadi taluk where tanneries are located [14].

IV. MATERIALS AND METHODS

The ground water samples from 7 villages within in Vaniyambadi taluk wells spread over this study area were collected and analyzed during the period of April 2018 to May 2018. Sampling is done at each station in Polythene bottles with 1000 ml volume capacity. Field parameters such as Lead, Aluminium, Nickel, Manganese, Chromium, Copper, Zinc, and Cadmium were measured at sampling site (Vaniyambadi taluk). Collected samples were brought to the laboratory to be analyzed.

V. RESULT AND DISCUSSION

Table 1: Concentration of heavy metal during Pre monsoon season in ground water samples collected from near tannery areas of Vaniyambadi - Vellore district (Samples 1- 7)

S.No	Heavy metals	BIS & WHO Requirements	Vani-W1	Vani-W2	Vani-W3	Vani-W4	Vani-W5	Vani-W6	Vani-W7
1.	Chromium	0.05	0.825	0.89	0.532	0.48	1.72	0.467	0.905
2.	Lead	0.01	0.414	0.202	0.308	0.188	0.74	0.342	0.282
3.	Zinc	5 – 15	9.38	12.14	7.42	10.24	12.08	9.08	7.28
5.	Iron	0.3-1.0	0.35	0.38	0.29	0.72	0.52	0.28	0.64
4.	Manganese	0.1- 0.5	0.172	0.312	0.234	0.208	0.298	0.324	0.274
6.	Nickel	0.02	0.054	0.034	0.072	0.062	0.028	0.038	0.058
7.	Aluminium	0.03 - 0.2	0.475	0.728	0.902	0.834	0.267	0.395	0.562
8.	Cadmium	0.003	0.001	0.002	0.003	0.007	0.008	0.002	0.003
9.	Copper	0.05 - 1.5	4.45	7.94	5.58	3.39	6.8	5.88	7.57

Note: Unite of all heavy metal concentration – mg/L, Vani – W: Vaniyambadi water samples

Table 2: Concentration of heavy metal during Post monsoon season ground water samples collected from near tannery areas in villages of Vaniyambadi taluk - Vellore district (Samples 1 - 7)

S.No	Heavy metals	BIS & WHO Requirements	Vani-W1	Vani-W2	Vani-W3	Vani-W4	Vani-W5	Vani-W6	Vani-W7
1.	Chromium	0.05	0.652	0.852	0.524	0.452	0.985	0.367	0.894
2.	Lead	0.01	0.358	0.192	0.298	0.172	0.206	0.316	0.249
3.	Zinc	5 – 15	7.85	6.08	7.36	9.28	11.56	8.16	7.12
5.	Iron	0.3-1.0	0.34	0.32	0.18	0.66	0.24	0.32	0.56
4.	Manganese	0.2- 0.5	0.172	0.312	0.234	0.208	0.298	0.324	0.274
6.	Nickel	0.02	0.054	0.029	0.068	0.054	0.025	0.032	0.054
7.	Aluminium	0.03 - 0.2	0.396	0.658	0.852	0.822	0.254	0.378	0.548
8.	Cadmium	0.003	0.005	0.005	0.002	0.003	0.004	0.001	0.004
9.	Copper	0.05 - 1.5	4.28	2.46	3.16	3.28	6.12	3.26	5.96

***Note*:** Unite of all heavy metal concentration – mg/l, Vani – W: Vaniyambadi water samples

Table 3: Arithmetical Summary of heavy metal concentration of Ground Water collected from near tannery locations of Vaniyambadi- Vellore taluk

S.NO	Heavy metals	Post monsoon				Pre monsoon			
		Max	Min	Average	Sd	Max	Min	Average	Sd
1.	Chromium	1.72	0.467	0.758	0.257	0.985	0.367	0.675	0.27
2.	Lead	0.414	0.342	0.278	0.076	0.358	0.172	0.255	0.064
3.	Zinc	12.14	7.28	9.66	1.82	11.56	6.08	8.07	1.645
5.	Iron	0.72	0.28	0.454	0.161	0.66	0.18	0.374	0.159
4.	Manganese	0.324	0.172	0.261	0.052	0.324	0.122	0.235	0.068
6.	Nickel	0.074	0.29	0.049	0.015	0.068	0.023	0.044	0.016
7.	Aluminium	0.956	0.257	0.594	0.77	0.850	0.224	0.552	0.27
8.	Cadmium	0.010	0.007	0.0037	0.0024	0.007	0.001	0.0038	0.0018
9.	Copper	9.02	3.18	5.944	1.523	6.18	1.16	3.371	1.531

VI. RESULT AND DISCUSSION

From this analysis in this study area we observed that the concentration Chromium varied from 0.467 to 1.72 mg/L, 0.367 to 0.985 mg/L in Post monsoon and Pre monsoon respectively, Lead varied from 0.342 to 0.414 mg/L, 0. 172 to 0.358 mg/L in Post monsoon and Pre monsoon respectively, Zinc varied from 7.28 to 12.14 mg/L, 6.08 to 11.56 mg/L in Post monsoon and Pre monsoon respectively, Iron varied from 0.28 to 0.72 mg/L, 0.18 to 0.66 mg/L in Post monsoon and Pre monsoon respectively, Manganese varied from 0.28 to 0.072 mg/L, 0.023 to 0.068 mg/L in Post monsoon and Pre monsoon respectively, Nickel varied from 0.29 to 0.074 mg/L, 0.367 to 0.985 mg/L in Post monsoon and Pre monsoon respectively, Aluminium varied from 0.257 to 0.956 mg/L, 0.224 to 0.850 mg/L in Post monsoon and Pre monsoon respectively, Cadmium varied from 0.007 to 0.010 mg/L, 0.001 to 0.007 mg/L in Post monsoon and Pre monsoon respectively, Copper varied from 3.18 to 9.02 mg/L, 1.16 to 6.18 mg/L in Post monsoon and Pre monsoon respectively (Table 1, 2 &3).

VII. CONCLUSION

In this study it is revealed that the Pre monsoon season the concentration heavy metals in the collected groundwater samples collected from study area was not very good but whereas in the Post monsoon season the quality of water is quite appreciable due to the recharge of water source. The quality of water has improved by the dilution of chemical components in the water after rainfall.

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