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Original Research Paper

The Study of Water Quality of Ponnamaravathy in Pudukkottai District, Tamilnadu

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ABSTRACT

Assessment of physico-chemical parameters of water in three places in and around Ponnamaravathy of Pudukkottai district was carried out. Water samples from bore-wells and open-pond were collected and analysed. The chemical quality was compared with the drinking water quality standards. Several parameters like pH, turbidity, electrical conductivity, chloride, sulphate, total hardness, alkalinity, total dissolved solids, dissolved oxygen and biochemical oxygen demand were analysed. The results indicate that groundwater quality in the study area is not suitable for drinking, but the pond water can be used after pretreatment.

INTRODUCTION

Pollution of air, water and soil is unavoidable with the growth of industries in developing countries like India. These industries lead to alteration of physical, chemical and biological properties of the environment. Water is one of the essential natural resources for existence and development of life on the earth. Surface and groundwaters are the only major sources of water to meet out the entire requirement. They get contaminated in many ways. The groundwater is the safest and cheapest, hence, it becomes necessary to find out the impact of pollution on water sources and examine the hazardous effects on health of humans who consume water. Several studies have been conducted on the contamination of groundwater by toxic substances. At present, there are no data available on the physico-chemical characteristics of lake water and groundwater around Ponnamaravathy in Tamil Nadu. Ponnamaravathy is a small town far from industrialization. It is in the border of Pudukkottai district and Sivagangai district of Tamil Nadu. People from adjoining villages of this town come to this place for purchase of essential commodities. There are many jewellery shops here and this town had been once an important centre for fine arts. Here, there are many man-made ponds, from which water is taken for drinking purposes. They become dry in summer season and the only source of water is groundwater. In an year of normal rainfall, water will be present in these tanks for about nine months in a year. An attempt has been made to analyse the physico-chemical parameters of the open pond as well as bore well waters.

MATERIALS AND METHODS

Sampling procedure: Samples of bore well water and open pond water in and around Ponnamaravathy were collected in high grade plastic bottles of one-litre capacity after rinsing them with distilled water and thrice with the sample water before collection. The location and source of water samples are given in Table 1.

Analysis techniques: Samples were brought to the laboratory and the parameters like pH, electrical conductivity and total dissolved solids of water samples were measured immediately after sample collection. Other physico-chemical parameters were analysed within 36 hours. Standard methods were adopted for the analysis of the water samples (APHA-AWWA-WPCF1989).

Table 1: Location and source of water samples.

S.No	Sample Code	Location	Source
1	S_1	AmmanTemple,	Open pond
2	S_2	Pattamarathan Nagar	Bore-well
3	S_3	Indira Nagar	Bore well

RESULTS AND DISCUSSION

The water quality data of physico-chemical parameters of the study are given in Table 2. The data have been compared with Bureau of Indian standards (BIS 1998) drinking water standards.

Colour taste and odour: In the present investigation, the colour, taste and odour of the water samples were noted at the sampling point itself. All the three samples of water were found to be colourless. The odour and taste of the sample S_1 were found to be normal, and for the samples S_2, S_3 the odour was not disagreeable but they were found to be salty in taste.

Turbidity: The turbidity values ranged from 0.2 NTU to 0.5 NTU. The BIS acceptable limit for turbidity is 25 NTU. All the water samples analysed for turbidity were well within the permissible limit with reference to the BIS (1998) standards. As all the water sources are situated in residential areas well away from any industry which release polluting effluents, all the water samples were relatively clear and with acceptable odour.

pH: The values of the pH of the water samples varied from 7.4 to 8.9. The recommended value of pH for drinking purposes is between 6.5 and 9.2 (BIS 1998). In the present study all the water samples analysed were well within the safer limits. However, higher values of pH hasten the scale formation in water heaters and reduce the germicidal potential of chlorine.

Electrical conductivity: The values of electrical conductivity vary from 215 to 4314 μmhos/cm. The higher values of electrical conductivity in samples S_2 and S_3 of bore wells clearly indicate that the water from these sources is not fit for human consumption. The high electrical conductivity values are due to natural concentration of ionized substances present in water and due to higher total dissolved solids in the study area.

Total dissolved solids (TDS): Total dissolved solids is an important parameter for drinking water and water to be used for other purposes. It indicates the salinity of water. Water containing more than 500 mg/L of total dissolved solids is not considered desirable for drinking water supplies (Sastry & Rahee 1988). However in unavoidable cases 1500 mg/L is also used. In the present investigation, TDS varies from 144 to 2915 mg/L. Water samples S_2 and S_3 show very high TDS values and are unfit for human consumption. TDS concentration above the permissible limit causes gastrointestinal irritation.

Total hardness (TH): Total hardness levels varied from 48 mg/L to 164 mg/L. The BIS (1998) acceptable upper limit for total hardness is 600 mg/L. In the present study the hardness is within the limits.

Dissolved oxygen (DO): Dissolved oxygen is an important pollution parameter. Deficiency of dissolved oxygen gives bad odour to water due to anaerobic decomposition of organic matter (Sallae 1974). In the present study dissolved oxygen values of water samples vary from 10.7 to 16.6 mg/L.

Table 2: The physico-chemical parameters of water samples at three selected places in Ponnamaravathy with the standard values for comparison.

S.No.	Parameters	BIS (1998)		S1	S2	S3
		P	E			
1.	pH	6.5	9.2	7.4	8.9	8.6
2.	EC	-	1400	215	4250	4314
3.	Sulphate	200	400	9	251	95
4.	Chloride	250	1000	22	604	738
5.	BOD	-	5	7.5	1.9	7.8
6.	TDS	500	1000	144	2915	2710
7.	Total hardness	300	600	48	164	142
8.	Total alkalinity	200	600	59	902	743
9.	DO	-	-	11.2	10.7	16.6
10.	Turbidity	5	25	0.59	0.36	0.29

where P-permissible limit, E-Excessive limit. All parameters are expressed in mg/L except pH, colour (Hazen units) and electrical conductivity (EC) (μmhos/cm).

The DO level in natural water depends upon physical, chemical and biological activities prevailing in the water bodies. The amount of DO varies with water temperature and altitude also (Chhatwal et al. 1989).

Biochemical oxygen demand (BOD): The maximum desirable limit of BOD for drinking water is 5 mg/L. In the present investigation, BOD value of water samples varies from 1.9 to 7.8 mg/L. The water samples S_1 and S_3 have BOD values higher than the maximum desirable limit of 5 mg/L. The high BOD values clearly indicate pollution, which may be attributed to the percolation of wastewater loaded with biodegradable material.

Total alkalinity: In the present study total alkalinity values ranged from 59 to 902 mg/L. Total alkalinity value for the sample S_1 is higher than the BIS recommended values which stipulates 200 mg/L as the permissible limit and 600 mg/L as the excessive limit. The water sample S_2 shows maximum pH (8.9) and alkalinity (902 mg/L). Greater alkalinity shows the presence of alkali salts of sodium and potassium in addition to calcium and magnesium. The alkalinity data show that water sample in the study area S_1 is well within the permissible limit, but water samples S_2 and S_3 have high total alkalinity levels, which are above the excessive limit. Hence, the samples S_2 and S_3 are unfit for drinking purposes.

Chloride: Chloride is also one of the important parameters to know the quality of water. Sources of chloride include fertilizers, salt, human and animal wastes. Concentration of chlorides is considered to be indicator of organic pollution of animal origin. The present study showed chloride values ranging from 22 mg/L to 738 mg/L. The high chloride content may lead to high blood pressure, for people who use it. But, all the values are within the BIS excessive limit.

Sulphate: Sulphate is an important constituent of hardness. Excess sulphate has laxative effect and cause adverse effect on human health. It also imparts taste to water. The maximum desirable limit of sulphate in drinking water is 200 mg/L and the maximum permissible limit is 400 mg/L. Sulphate of water sample S_1 and S_3 was found to be within the desirable limit while in the sample S_2 it was above desirable limit but below excessive limit. Higher values of sulphate may cause gastrointestinal disorders in human beings.

CONCLUSION

The physico-chemical analysis of open-pond and bore-well water samples investigated shows that they are colourless with normal odour. The samples S_2 and S_3 are salty. Turbidity of all the samples does not exceed the permissible limit. The bore-well water samples S_2 and S_3 show high chloride, TDS and electrical conductivity values. The open-pond water sample S_1 is used for drinking water needs, often without any pretreatment. It is suggested that the pond water may be pretreated before drinking. People in and around Ponnamaravathy depend on groundwater sources when the pond becomes dry; and this study shows that the physico-chemical values are above the excessive limit, suggesting that they are unfit for human consumption. Hence, it is suggested that pretreatment methods like reverse osmosis be used before using the water from bore well for drinking purpose.

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