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A Study of Ground Water Quality on the Bank of Santhanavarthini River, Dindigul Town, Tamil Nadu, India

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ABSTRACT

Groundwater samples were collected from different locations in and around Santhanavarthini River, Dindigul town, Tamil Nadu. Ten groundwater samples were analyzed for their physico-chemical characteristics. The obtained results are compared with the WHO standards. The samples were subjected to physico-chemicals analysis. Total dissolved solids (TDS), total hardness, chloride and sulphate, phosphate, dissolved oxygen, mg, chemical oxygen demand (COD), and demand oxygen (DO) values are exceeded the permissible limit of WHO standards in most of the ground groundwater samples.

1. Introduction

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities [1]. The quality of any body of surface or ground water is a function of either or both natural influences and human activities [2, 3]. It is now generally accepted that aquatic environments cannot be perceived simply as holding tanks that supply water for human activities. Rather, these environments are complex matrices that require careful use to ensure sustainable ecosystem functioning well into the future [1].

Rivers are the most important freshwater resource for man. Unfortunately, river waters are being polluted by indiscriminate disposal of sewerage, industrial waste and plethora of human activities, which affects their physico-chemical characteristics and microbiological quality [4]. Pollution of the aquatic environment is a serious and growing problem. Increasing numbers and amounts of industrial, agricultural and commercial chemicals discharged into the aquatic environment have led to various deleterious effects on aquatic organisms. Aquatic organisms, including fish, accumulate pollutants directly from contaminated water and indirectly via the food chain [5-7].

Water is the one of the most common yet the most precious resources on the earth without which there would be no life on earth. Pollution is a serious problem as 70% of India's surface water resources and as growing number of its ground water reserves have been contaminated by biological, organic and inorganic pollutants. Adequate supply of potable safe water is absolutely essential and is the basic need for all human being on the earth. The studies of the interaction of ground water and surface water were directed primarily at large alluvial stream and aquifer systems [8].

In recent times because of rapid urbanization and growth of population, an enormous demand for fresh water is raising day by day in developing countries like India. Due to the massive needs of freshwater both in rural and urban areas for domestic and industrial purposes, it is essential that its quality should be maintained [9], specially for the state of Tamilnadu where the people of rural areas are greatly depended upon the underground water, stream water or other surface water sources for drinking and other domestic purposes. So, it is become crucial to monitor the quality of water which is used for drinking and domestic purposes and also to find out the remedial measures to protect freshwater sources. Because, whenever the fresh water sources are infected their quality cannot be renovated by stopping the pollutants from the source [10-13]. Hence the present study has been undertaken to investigate the physico-chemicals analysis of groundwater on the bank of Santhanavarthini River at Dindigul town.

2. Experimental Methods

The study area of the Santhanavarthini River lies in the Dindigul town. The study pertains to the quality of Santhanavarthini River water and their impacts on the ground water. Ten groundwater sampling stations are selected. They are represented as S1 to S10. The groundwater samples were taken from the bore wells on either side of the Santhanavarthini River basin of each station. The water samples were collected in 500 mL polyethylene bottles. Before the collection of sampling bottles were soaked with 1:1 HNO_3, washed using double distilled water. At the time sampling, the sampling bottles were thoroughly rinsed three times using the groundwater to be sampled. The samples were subjected to physico-chemical analysis. The collected groundwater samples were stored in an icebox and brought to laboratory for determining both physico-chemical parameters (Table 1).

Table 1 Analysis of the contaminated water

S.No	Parameter	Units	Method of Analysis
1	Colour	Hazen Units (Hz)	Visual comparison
2	Turbidity	NTU	Neplo turbidity meter
3	TDS	mg/L	Conductivity method
4	Electrical conductivity	µS/cm	Conductivity meter
5	pH	pH unit	pH Meter
6	Total hardness	mg/L	EDTA titrimetric method
7	Calcium	mg/L	EDTA titrimetric method
8	Magnesium	mg/L	Calculation from total hardness
9	Iron	mg/L	Spectrophotometer
10	Ammonia	mg/L	Nessler's method
11	Nitrite	mg/L	Spectrophotometer
12	Nitrate	mg/L	Spectrophotometer
13	Chloride	mg/L	Silver nitrate
14	Fluoride	mg/L	Colorimetric meter
15	Sulphate	mg/L	Turbidity method
16	Phosphate	mg/L	Spectrophotometer

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Table 2 Physico-chemical characteristic of ground water in Dindigul town

Stations	pH	EC (µS/cm)	TDS (mg/L)	TH (mg/L)	HCO_3 (mg/L)	Cl (mg/L)	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	NO_3 (mg/L)	SO_4 (mg/L)	PO_4 (mg/L)	BOD (mg/L)	COD (mg/L)	DO (mg/L)
BIS	6.5 - 8.5	250-2250	500 - 2000	300 - 600	250 - 600	250 - 1000	40	20	75 - 200	30 - 100	45 - 100	200 - 400	6.5	6	10	6
S1	7.6	5265	3456	1426	340	1100	58	35	280	98	65	120	0.15	22	16	5.7
S2	7.4	4826	3125	1004	286	985	46	26	159	88	54	86	0.12	20	15	5.3
S3	7.3	4060	2932	1280	940	486	80	13	275	121	35	118	0.34	16	16	4.6
S4	7.7	5562	3868	1400	380	1740	190	46	454	136	32	67	0.26	16	23	5.5
S5	7.8	2782	1791	760	378	645	58	35	158	69	21	83	0.13	46	58	3.1
S6	7.9	4396	3247	1240	380	1285	86	20	610	70	91	153	0.17	11	20	5.9
S7	7.1	2219	1313	580	446	370	67	30	154	56	16	127	0.32	18	33	4.4
S8	7.4	2605	1956	1956	830	670	440	51	190	76	22	80	0.19	14	25	4.6
S9	7.3	3433	2340	940	545	780	84	21	240	73	38	165	0.08	83	66	2.3
S10	7.5	1795	1340	572	640	230	46	23	141	47	18	46	0.15	17	11	5.9

3. Results and Discussion

Raw water quality and standards depend upon the use. The four main uses are municipal, industrial, agricultural and recreational (fish and wildlife). As water quality is degraded day by day, so, it becomes very important to set the drinking water standards for the safety of water of our limited resources. Different agencies have set environment standards for safe drinking water as Bureau of Indian Standards (BIS), World Health Organization (WHO), and European Economic Community (EEC) etc. Drinking water standards are regulation that Bureau of Indian Standards (BIS) set to control the level of contamination in the drinking water. Bureau of Indian Standard considers the inputs from several organization i.e. Central, State, Semi Government, Municipal Corporation, Public Health Organization, etc. throughout the standard setting process.

Parameters like TDS, EC, hardness, calcium, magnesium, Iron, fluoride, Sulphate, BOD, COD and DO are taken as sensitive parameters to indicate the water pollution by Santhanavarthini River from different sources. It is observed that the values are higher compared the BIS Standards.

4. Conclusion

The present study reveals that most of the groundwater samples at Santhanavarthini River basin in and around Dindigul town were found that the water quality parameters are higher than the permitted level as per BIS standards. Specifically high turbidity, high TDS and higher electrical conductivity value which indicates that the water cannot be used for human consumption. Physico-chemical analysis of various water samples collected at the study area are having the higher value of sensitive parameters like TDS, calcium, chloride, magnesium, nitrate, pH, turbidity. Hence the people cannot use that water to any domestic purposes. So the people have to bring the water from municipal water supply. This calls for proper treatment, disposal and management of pollutants. Effective collection, treatment and disposal of industry wastes can help to protect the ecosystem and ensure sustainable development. This problem should be attended and controlled at the earliest for the sake of people health, environmental safety, soil and water quality because once the ground water and soil are polluted, it is difficult to restore it to its initial quality. Hence the polluted water is subjected to water treatment using reverse osmosis system.

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