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PHYSICAL PROPERTIES OF CHEMICAL SUBSTANCES ANALYSIS OF PARTICULAR SUBSURFACE WATER SAMPLES OF CHIDAMBARAM TALUK, TAMILNADU

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ABSTRACT

As the subsurface water is the important constituent of water system and pollution of which results in contamination of various water bodies. Physical properties of chemical characteristics of subsurface water and municipal water in chidambaram taluk were studied by taking water samples from different stations. The research was carried out by collecting some subsurface water samples during May 2018— June 2018. The results were compared with standards prescribed by WHO and ISI 10500-91. Total 15 parameters were analyzed. It was found that the ground water was polluted at few sampling sites namely Poonthotham, Sethiyathope and Maduranthaganallur The sampling sites Palayamserndhangudi and Vellikudi showed physicochemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose.

Keywords: Physicochemical characteristics, Ground water, Water pollution, Drinking water

INTRODUCTION

Almost two thirds of Earth's surface is covered with water less than a third taken up by land. When poisonous substances enter lakes, rivers, ponds, oceans, reservoir and various water bodies, the suspended and dissolved particles of water get deposited on the bed. This results in the contamination and pollution of water whereby the quality of the water to become worse, affecting aquatic life and ecosystems. Almost water polluting sources are the city sewage and industrial waste

discharged into the rivers. The treatment facilities of waste water are not adequate in any city in India. Presently, only about ten percent of the sewage waste water and industrial waste water generated is treated; the rest is discharged as it is into our water bodies. Due to this, contamination and pollutants enter subsurface water, rivers, lakes, and other kind of water bodies. Such water, which is finally ends up in our households, is often highly contaminated and carries disease causing microbes. Agricultural run-off, or the water from the fields that drains into rivers, is another major water pollutant as it contains fertilizers and pesticides.

Nowadays, many people dump their garbage into lakes, streams, rivers, and oceans, thus making water bodies the final resting place of cans, bottles, plastics, and various household products. The other substances that we use for keeping our houses clean add to water pollution as they contain harmful chemicals. In the past, people almost used soaps made from animal and vegetable fat for all types of washing. But now a day's cleaning products are synthetic detergents and come from the petrochemical industry. Almost all kind of detergents and washing powders contain phosphates, which are used to soften the water among other things. These and other chemicals contained in washing powders affect the health of all forms of

life in the water. Routine applications of fertilizers and pesticides and chemicals for agriculture and indiscriminate disposal of industrial and domestic wastes are increasingly being recognized as significant sources of water pollution. More seriously, contaminated water destroys aquatic life and reduces its reproductive ability. When sewage enters a lake or stream, micro-organisms begin to decompose the organic materials. Oxygen is consumed as microorganisms use it in their metabolism. This can quickly decrease the available oxygen in the water. Excessive nutrients can produce problems such as bad tastes and odours as well as green scum algae. Also the growth of rooted plants increases, which deplete the amount of oxygen in the deepest waters of the reservoir and lake. It also leads to the death of all forms of life in the water bodies. The rapid growth of urban areas has further affected subsurface water quality due to overuse of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of groundwater quality (Trivedy and Goel, 1986) considering the above aspects of groundwater contamination, the present study was undertaken to investigate the possible impact of the subsurface water quality of some water samples in Chidambaram town of Cuddalore district of Tamil Nadu region. Thus, in this paper an

attempt has been made to assess the physical and chemical properties of subsurface water.

EXPERIMENT CONDUCTED

Chidambaram town in Cuddalore district is situated at northern region of Tamil state. The people are using shallow well water, deep well water as well as municipal water for their daily use. The literature survey reveals that no water quality management studies are made in this region so far. Hence the present study was planned and undertaken. Five sites to collect water samples were selected from different places of Chidambaram and around Chidambaram.

Preparation of water samples

The samples were collected in plastic canes of 3 litre capacity without any air bubbles as per standard procedure. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator maintained at 4°C. Water samples from five sampling points situated at different places were collected during a post monsoon period of four months **(May, 2018 to June, 2018)**. The sampling locations is given in **Table 1**.

Table 1: Sample Location

Sample no.	Sample Location	Source
S1	Poonthotham	Ground Water
S2	Sethiyathope	Tab Water
S3	Maduranthaganallur	Ground Water
S4	Palayamserndhangudi	Raw Water
S5	Vellikudi	Ground Water

Physicochemical analysis

Analysis was carried out for various water quality parameters such as pH, electrical Conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), nitrate (NO_3^-) sulphate (SO_4^{2-}), phosphate (PO_4^{3-}),total alkalinity (TA), total hardness (TH , chloride (Cl^-) using standard method (American Public Health Association (1989), Trivedy and Goel, (1986), Manivaskam (2005). The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions.

RESULTS AND DISCUSSION

pH

pH is a term used universally to express the intensity of the acidity or alkalinity condition of a water. Most of the waters are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 7.1 to 8.0 and were found within the limit prescribed by WHO.

The average results of the physicochemical parameters for water samples are presented in **Table 2**.

Total dissolved solids (TDS)

Total dissolved solids indicate the salinity behaviour of subsurface water. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/L is also allowed (Ball, 1994). TDS values of present samples varied from 82 mg/L to 755 mg/L. The sampling points S3, S4 and S5 showed higher TDS values than the prescribed limit given by ISI 10500-91. High values of TDS in subsurface water are generallynot harmful to human beings but high concentration of these may affect persons, who are suffering from kidney and heart diseases (Gupta et al., 2004). Water containing high solid may cause laxative or constipation effects (Shrinivasa Rao and Venkateswaralu, 2000).

Turbidity

In most waters, turbidity is due to colloidal and extremely fine dispersions. The turbidity values are 0(zer0) NTU and found within the limits prescribed by ISI 10500-91.

Dissolved oxygen (DO)

Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO values varied from 5.1 to 8.2. The sampling points S1, S2, S3, S4 and S5 showed DO values which are within the range indicating no contamination by organic matter.

Alkalinity

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. The alkalinity values in the study area found to vary from 321 to 601 mg/L. Total alkalinity values for all the investigated samples were found to be greater than the value prescribed by WHO. Alkalinity around 150 mg/L has been found conductive to higher productivity of water bodies (Ball, 1994).

Total hardness (TH)

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water (Trivedy and Goel, 1986). Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 170 mg/L to 870 mg/L. The values for tube well sample from point S2 and open well sample from point S3 were higher than the prescribed limit. The water samples from Vijayawada urban area mostly exceeded the minimum tolerance limit for total hardness of 100 and 200 ppm of WHO and CPHEEO standards respectively. But none

of the samples cross the maximum permissible limits of 500 and 600 ppm of WHO and CPHEEO standards.

Chloride (Cl⁻)

The chloride concentration serves as an indicator of pollution by sewage. Chloride is a widely distributed element in all types of rocks in one or the other form. Its affinity towards sodium is high. Therefore, its concentration is high in ground waters, where the temperature is high and rainfall is less. Soil porosity and permeability also has a key role in building up the chlorides concentration (Chanda, 1999). People accustomed to higher chloride in water are subjected to laxative effects (Sudhir Dahiya and Amarjeet Kaur, 1999). In the present analysis, chloride concentration was found in the range of 119.98 mg/L to 188.9 mg/L. The values are within the limit.

Nitrate (NO₃⁻)

Groundwater contains nitrate due to leaching of nitrate with the percolating

water. Ground water can also be contaminated by sewage and other wastes rich in nitrates. The nitrate content in the study area varied in the range 0.05 mg/L to 0.75 mg/L and found within the prescribed limit.

Sulphate (SO₄²⁻)

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The sulphate concentration varied between 21.43 mg/L and 89.78 mg/L. and found within the prescribed limit.

Phosphate (PO₄³⁻)

Phosphate may occur in groundwater as a result of domestic sewage, detergents, agricultural effluents with fertilizers and industrial waste water. The phosphate content in the study area was found in the range of 0.15 mg/L to 0.26 mg/L.

Table 2: Average results of the physicochemical parameters

S. No	Parameter	Sampling points					WHO 1973	ISI 1050091/CP HEEO
		S1	S2	S3	S4	S5		
1	Colour (Hazen unit)	O	O	O	O	O		
2	Odour	Odourless	odourless	Rusty odour	Rusty odour	Odourless		
3	Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless		
4	pH	7.4	7.4	7.61	7.61	7.31	7-8.5	6.5-8.5
5	EC							
6	TDS	82	84	702ppm	759	506	500-1500	500-1500
7	Turbidity (NTU)	0	0	0	0	0	5	10
8	DO	8.1	8.2	5.3	5.1	5.2	-	5.0
9	BOD			9	12	73		
10	TH(ppm)	146	162	299	365	322	200-600	

11	TA(ppm)	341	346	459	601	321	120	200
12	Cl^- (ppm)	123	121	129	188.9	119.98	250	250
13	NO^{3-}	0.05	0.06	0.46	0.74	0.75	5	45
14	SO_4^{2-}	21.43	21.55	57.99	61.45	89.78	250	250
15	PO_4^{3-}	0.15	0.15	0.26	0.26	0.26	-	-

CONCLUSION

Deviations were observed by subsurface water samples indicating ground water pollution. Water collected at Palayamserndhangudi and Vellikudi were found to be fit for drinking purpose. The water samples from sites S3, S4 and S5 showed poor water quality as compared to other water samples, probably due to sewage pond close to those sites. The water samples from sites S3, S4 and S5 are polluted. The sampling site S1 and S2 showed physical and chemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose.

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