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Study on Physico-Chemical Parameters of Water Samples in and around Salem District, Tamil Nadu, India

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Abstract

Ground water quality is one of the most important criteria to ascertain its suitability for human beings and irrigation. Water plays vital role in human life and extremely essential for survival of all living organisms. In the present study the water samples were collected from the existing open wells, bore wells, lakes, river and drinking water supply from the five different places in and around Salem district, Tamil Nadu. The physico-chemical characteristics such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA), Dissolved Oxygen (DO), Calcium (Ca^{2+}), Magnesium (Mg), Sodium (Na), Iron (Fe), Chloride (Cl) and Fluoride were analyzed for a period of three months from December, 2010 to February, 2011. The present study was investigated the quality of surface and groundwater samples.

Key Words: Physic-Chemical Parameters, Drinking water, Sewage water, Tap water, Well water and Lake water

Introduction

Environmental contamination due to anthropogenic and natural sources is increasing day by day because of increase in population, industrialization and urbanization. The enigma for the public, scientists, academicians and politicians is how to tackle the contaminants that jeopardize the environment (Ahemad and Kibret 2013; Shukla *et al* 2010). Water is one of the most vital elements of the human environments. It is being used for many purposes e.g., industrial water

supply, irrigation, drinking, propagation of fish and other aquatic systems and generation of hydro-power plants. Water is the main source of energy and governs the evolution on the earth. 71% of earth surface is covered by water (CIA 2008), 96.5% of the World's water is sea water which is salty that is not to be directly useful for irrigation, drinking, domestic and industrial purposes.1.7% in groundwater, 1.7% in glaciers and the ice caps. Less than 1% water is present in ponds, lakes, rivers, dams, etc., According to an estimate about 70% of all the available water in our country is polluted due to the discharge of effluents from the industries, domestic waste, land and agricultural drainage (Shrivastava and Kanungo 2013).

Natural resources are the important wealth of our country, water is one of them. Water is a wonder of the nature. "No life without water'' is a common saying depending upon the fact that water is the one of the naturally occurring essential requirement of all life supporting activities (Simpi *et al* 2011). Water pollution can come from a number of different sources. Sometimes the pollution may affect the environment hundreds of miles away from the source (Rivas *et al* 2003; Krantz and Kifferstein 2010).

The Salem district is an important industrial and agricultural center located in semi-arid Southeast India. In recent years, rapid development has created an increase in demand for groundwater. Detailed knowledge of water quality gives a brief insight on the hydro chemical system, promoting sustainable development and effective management of groundwater resources. Ground water is the principal source of drinking water in both rural and urban parts of India. The safety of drinking water is assured and taken for granted by consumers in most developed countries. The quality of ground water vary with geology of the particular area, depth of water, seasonal changes, composition of dissolved salts depending upon sources of salt and surface environment (Mohamed Hanipha and Zahir Hussain 2013). Chemicals are a major source of water contamination that introduced during water movement through geological materials (Kataria *et al* 2011). Fertilizers and pesticides are major contributors to water pollution. Weathering of rocks, leaching of soils and mining processing, etc., are contaminate natural water (Manjare *et al* 2010).

Health effects from contaminated groundwater depend on the specific pollutants in the water. Pollution from groundwater often causes diarrhoea and stomach irritation, which can lead to

more severe health effects. Accumulation of heavy metals and some organic pollutants can lead to cancer, reproductive abnormalities and other more severe health effects. The functioning of an aquatic system depends to a great extent on the physicochemical characteristics of its water (Josephine Sharmila and Rajeswari 2015). The present study was undertaken to investigate the impact of surface and groundwater quality of water samples in and around at Salem district Tamil Nadu. Thus, in this research work an attempt has been made to assess the physical and chemical parameters of water samples.

Materials and Methods

Sample collection

Water samples have collected from the existing open wells, bore wells, lakes, river and drinking water supply from the various places in Salem district i.e. Mettur (drinking water), Sankagiri (Tap water), Gangavalli (Well water), Attayampatti (Sewage water) and Omalur (Lake water). Grab sampling, a multimedia sample collection technique comprising discrete aliquots collected from one specific sampling location at a specific point of time was adopted in the present study (Butterfield 2000). The sample was taken from a particular container so that it could be relocated for further investigations whenever required. The water samples was collected in polythene containers (35 L capacity) which were pretreated by soaking in 10% HNO_3 for 48 h. Sample was preserved by adding 5 ml of concentrated nitric acid per liter of sample and transported to the analytical laboratory. The containers were rinsed with the sample just before collection.

Study period

The present study was carried out over a period from December, 2010 to February, 2011 and sample was collected at thirty days interval.

Characterization of Waters sample

Physico-chemical characteristics of the water samples were analyzed using standard analytical procedures (APHA 1980; Vogel 1975) and the results were compared with the Standards prescribed by The Central Public Health Environmental Engineering Organization (CPHEEO, 1993), Ministry of Urban Development, Government of India.

Results and Discussion

Table 1 shows the physic-chemical analysis of the five water samples from the various place of Salem district, revealed parameters such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS). Total Hardness (TH), Total Alkalinity (TA), Dissolved Oxygen (DO), Calcium (Ca^{2+}), Magnesium (Mg), Sodium (Na), Iron (Fe), Chloride (Cl^-) and Fluoride were higher than the permissible limits of Central public health environment engineering organization (CPHEEO 1993).
The pH value of water source is a measure of the hydrogen ion concentration in water and indicates whether the water is acidic or alkaline (Mohamed Hanipha and Zahir Hussain 2013). In the present study all the water samples have pH value between 8.0-8.5.Variation in pH values of water samples can affect the rate of biological reactions and survival of various microorganisms. High or low pH values in water have been reported to affect aquatic life and alter toxicity of other pollutant in one form or the other (DWAF 1996). High pH value indicates the formation of trihalomethanes, which are toxic, while pH below 6.5 state corrosion in pipe there by releasing toxic metals such as zinc, lead, cadmium and copper (Shrivastava and Patil 2002).

The electric conductivity (EC) of water is a measure of the ability of a solution to conduct an electric current. The conductivity of the water is one of the important parameter used to determine the suitability of water for irrigation. It is useful indicator for salinity or total salt content of waste water (Sankpal and Naikwade 2012).The present study EC values are in the range of 2760-4470 mic.m/cm indicating the presence of high amount of dissolved inorganic substances in ionized form. Increase in EC values indicates the presence of higher concentration of ions (Deepali *et al* 2009). The higher levels of EC alter the chelating properties of receiving systems, which favors free metal availability to flora and fauna (Nagajyothi *et al* 2009).

Total dissolved solids indicate the salinity behavior of groundwater. 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 (Shrinivasa Rao and Venkateswaralu 2000), highly mineralized water may be used where better quality water is not available (Jain 2002). In the present study high concentration of total dissolve solids in the range of 1930-3125 mg/L. The total dissolved solids (TDS) may increase salinity of the water and thus may render it unfit for irrigation and drinking purposes. Consumption of water with high concentrations of total dissolved solids has

been reported to cause disorders of alimentary canal, respiratory system, nervous system, coronary system besides, causing miscarriage and cancer (Reddy and Subba Rao 2001).

Water hardness is understood as a measure of the capacity of water to precipitate soap. The increase in the maximum level of total hardness is due to presence of carbonate and non carbonate compounds (Ramesh *et al* 2013). In the present study, the total hardness is very high amount of all the water samples. Calcium it is directly related to hardness and plays an important role for proper bone growth. The rock, lime stone and industrial waste are the rich sources of calcium from where it is leached in the ground water. The concentration of calcium varied from 168-250 mg/L. In the present study, the high concentration of calcium in the surface and ground water are due to rapid industrialization and urbanization. The high concentration of iron in water affects target organs which are the liver, cardiovascular system and kidneys. Eating food or drink contaminated with large amounts of magnesium can cause stomach irritation. Extremely high magnesium exposure in children may affect brain development. Hence children may be more sensitive than adults (HPA 2010).

Chloride in ground water can be caused by industrial or domestic waste. Its concentration serves as an indicator of pollution by sewage. In the present investigation, the chloride content varies from 340-600 mg/L. High chloride content in water bodies, affects agricultural crops, metallic pipes and are injurious to people suffering from to heart and kidney diseases. Its concentration is generally high is ground waters, where the temperature is high and rainfall is less (Chapolikar *et al* 2009). The chloride is found in the groundwater is sodium chloride. Soil porosity and permeability plays a major role in building up of the chloride concentration. The higher consumption can cause significant increase in the development of hypertension, risk for stroke, left ventricular hypertension, osteoporosis, renal stones and asthma in human beings (Mc Carthy 2004; Ramesh and Soorya 2012)**.**

The carbon dioxide content of any aquatic body is the best single index to decide the ruitability of water for animals and other living beings. In the present study, the free carbon dioxide values were found to be varied from 6.5-9.4. The high level indicate high organic load. Probable source of high fluoride in Indian waters seems to be that during weathering and circulation of water in rocks and soils fluorine is leached out and dissolved in ground water (Murhekar Gopalkrishna

2011). In the present case, the value of fluoride concentration in water samples lie between 1.0-1.4 mg/L. Fluoride, although known to prevent early stage tooth decay, high level of its concentration in drinking water and food have been found to have serious health effects in humans and animals, like mottled teeth that occur in children (Mc Dongh *et al* 2004).

Table 1: Physico-chemical characteristics of water samples at five different sampling locations of Salem district

S. No	Parameters	CPHEEO	Water Samples				
			Drinking water	Sewage water	Tap water	Well water	Lake water
1	Appearance		Colorless	Slightly Brownish	Blackish	Brownish	Greenish
2	Turbidity NT units	2.5 NTU 10	140	12	270	21	310
3	Electrical Conductivity	mic.mho/cm	2760	4470	3840	2780	2990
4	Total Dissolved Solids	500	1930	3125	2680	1940	2020
5	pH	6.5	8.5	8.9	7.1	8.0	8.0
6	Temperature	29^0C	29	29	30	29	28
7	Alkalanity pH as CoCo3	200	444	650	450	552	436
8	Total Hardness	200	720	920	836	680	748
9	T.S	500	2110	3165	3040	1970	2460
10	T.S.S	-	180	40	360	130	440
11	Iron	0.3	0.8	1.8	1.7	1.5	0.8
12	Magnesium	0.4	75	69	95	63	80
13	Calcium as Ca	70	149	250	176	168	170
14	Sodium	100	265	530	395	310	240
15	Potassium	10	40	85	65	25	40
16	Nitrate as NO_2	45	41	65	60	43	50
17	Chloride as Cl	200	340	600	464	380	350
18	Fluoride as F	1	1.0	0.4	0.4	0.0	1.4
19	O_2	-	2.0	8.0	5.4	5.0	3.2
20	CO_2	-	2.4	6.5	8.9	9.4	8.4

All values are expressed as mg/l except the values of pH and electrical conductivity

Conclusion

Deterioration of water quality and eutrophication are due to casual attitude of people. Human activities include bethinks, washing of clothes, vehicles and household utensils etc. even though nature has got its own mechanisms to take care of the wastes when they are in limited quantities, all physico-chemical parameters showed higher values. Thus, it can be concluded that these characteristics of water bodies are influenced by seasonal variations. It is recommended that the proper maintenance of the water bodies is necessary. Proper sanitation measures and environmental education to public care essential to keep these water bodies clean and safe.

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Conflicts of Interest

The authors declare that there are no conflicts of interest associated with this article.

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