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A Study of the Quality of Ground Water from Maruthanikulam Area due to Flow of Industrial Effluent and Sewage at Pillaiyar Natham of Dindigul District

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Abstract

The investigator has taken an attempt has been made to find impact of the Pillayar Natham Maruthani Kulam on the ground water in around the study area. The study was carried out to assess the magnitude of the pollution problem due to sewage and industrial effluent in Pillayar Natham. The aim is to analyze and to understand the toxic effects of effluents, sewage and hospital, effluents on the agriculture land. A public well in the study area, which was once an important source of drinking water for the whole village, is considered as a deep pit with polluted water. The village women have to walk two to three kilometers to fetch the drinking water from municipal source. A farmer with 1000 coconut trees in, his land reported that the yield from all the trees is very poor. With the decline in productivity, the agricultural land value has also decreased. The ground water on both sides of bond is polluted by percolation of the effluent. Water quality analysis of bore water and open well water collected from the study area reveals that the water cannot be used for domestic and agricultural purposes due to higher values than the BIS standards.

Keywords: *BIS Standards; Surface Water; Sewage; Tannery Effluents.*

1. INTRODUCTION

Water is a major natural resource, Water is used in many ways - e.g., as a nourishes of plant and animal life, a bearer of food, a prime element of industrial processes and a medium for transportation. The importance of water can be put into perspective by the fact; that a significant portion of the earth's surface is water. When our planet is viewed from space, the dominant blue colour makes water appear to be an abundant resource. The reality is that 97% of the earth's water is salty and the majority of the under 3% that is freshwater is locked in glaciers and polar ice caps.

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It is established that a single tannery can cause the pollution of groundwater around the radius of 7–8 km (Ansari *et al.* 1999). Chromium present in effluent is primarily in the less toxic trivalent form (Cr^{3+}) but when this effluent is discharged into the soil, due to varying environmental conditions, Cr^{3+} is oxidized to toxic hexavalent form, which seldom remains as Cr^{6+} (Anderson 1999; Selvakumar and Manoharan, 2002; Srinivasa Gowd *et al.* 2005; Thangarajan *et al.* 1999;

Mondal and Singh, 2005). Several authors have reported about the presence of contaminants in soils (Wu, 1980) and waters (Kolpin *et al.* 1998) in various part of the globe and also in India (Srinivasa Rao *et al.* 1997; Elango *et al.* 2003). Contamination of the ground water by domestic, industrial effluents and agricultural activity is a serious problem faced by developing countries.

Worldwide population growth as well as increases in industry is complex lifestyles create ever increasing demands on the planet's relatively finite sources of freshwater. To ensure a global water resource to meet the demands of the future, immediate improvements are need in techniques for water conservation, collection, storage, treatment, and reuse.

1. 1 Water Quality

Water is a solvent and dissolves minerals from the rocks with which it comes in contact. Ground water may contain dissolved minerals and gases that give it the taste enjoyed by many people. Without these minerals and gases, the water would taste flat. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulfate. In water chemistry, these substances are called common constituents.

Water typically is not considered desirable for drinking if the quantity of dissolved minerals exceeds 500 mg/L (milligrams per liter). Water with a few thousand mg/L of dissolved minerals is classed as slightly saline, but it is sometimes used in areas where less-mineralized water is not available. Water from some wells and springs contains very large concentrations of dissolved minerals and cannot be tolerated by humans and other animals or plants. Many parts of the Nation are underlain at depth by highly saline ground water that has only very limited uses.

Over 97% of all the water on earth is salty and most of the remaining 3% is frozen in the polar ice caps (Bhattacharya *et al.* 2012). The Atmosphere, River, lakes, and underground stores hold less than 1% of all the fresh water needed to support the earth's population (Venkateswara Rao, 2011). Most fresh water pollution is caused by the addition of organic material is mainly sewage but can be food waste or farm effluent, bacteria and other micro-organism feed on organic matter and large populations quickly develop using up much of the oxygen dissolved in the water. The chemical waste products from industrial process are sometimes accidentally discharged in to river (Indrani Gupta, 2011). Examples of such pollutants include cyanide, zinc, lead, copper, cadmium, and mercury (Rajmohan and Elango, 2005). This substance may enter the water in such high concentration that fish and other animals are killed immediately (Jain Pradeep,1998) .These are several source of water pollution which work together to reduce overall water quality.

2. SCOPE AND OBJECTIVES FOR THE STUDY

The quality of water in the Pillayar Natham Mullai Pond in Dindigul District are to be studied due to the continuous discharge of sewage and industrial effluents in to the pond. Without any treatment due to the percolation, the pond water seep in to nearby water sources like bore well and well are completely polluted. Hence the study of ground water quality around the pond is essential.

2.1 Objectives

- To Study the Physico– Chemical parameters in the Pillayar Natham Mullai Pond in Dindigul District.
- To evaluate the ground water quality in the wells and bore wells in and around around the Pond.
- To treat the contaminated ground water using Reverse osmosis technology in order to reduce the total dissolved solids (TDS) in the ground water.

3. MATERIALS & METHODS

Tanneries and houses are located around the Pillayar Natham Mullai Pond. It is located on Madurai road of Dindigul. The Pond is in the Municipal limit. People living in and around the pond are depending on ground water and well water. People are using the around pond as a swimming pool for the cows and buffalos. The pond water and the ground water were taken for the study.

3.1 Physico-Chemical Analysis of Different Parameters

S.No	Parameters	Method of Analysis
1.	pH	pH meter
2.	Electrical Conductivity	Conductivity meter
3.	Turbidity	Turbidity meter
4.	Total Dissolved Solids	Weight loss methods or TDS meter
5.	Hardness, Calcium	EDTA Titration
6.	Magnesium	Titration
7.	Iron	Spectrophotometer method at 510 nm
8.	Sulphate	Turbidity meter
9.	Nitrate	Brucine sulphate method at 410 nm
10.	Phosphate	Spectrophotometer method at 690 nm
11.	Fluoride	Colorimetric method

4. METHOD OF SAMPLING AND ANALYSIS OF WATER QUALITY PARAMETERS

Water samples from the Pillayar Natham Mullai Pond and the wells and bore wells on all directions in and around the Pond were collected from the sampling sites in a clean polythene bottle. Dissolved oxygen (D.O) was analyzed immediately after collection at the site using DO meter. Water samples were brought to the laboratory for analyzing the physico-chemical characterises of water. Samples were analyzed by as per standard procedure. The samples were collected during pre monsoon months. The results are tabulated below.:

4.1 Variation of Chemical Parameters in different water sample

Parameter	S1	S2	S3	S4	S5	S6	S7	S8	S9	Permissible limit
P^H	7.1	7.0	7.6	7.9	7.4	7.2	7.4	7.5	7.4	7.0- 8.5
Turbidity NT	32	9	9	7	6	9	7	8	6	1
Total Hardness	2000	2100	1700	1400	1801	1984	1710	1650	1560	200
Calcium as Ca	420	455	397	394	360	320	316	380	290	75
Magnesium as Mg	260	220	254	270	210	250	200	160	150	30
Nitrite as NO_2	0.11	0.15	0.16	0.14	0.13	0.11	0.14	0.13	0.12	-
Nitrate as NO_3	0.15	0.11	0.50	0.9	0.8	0.67	0.6	0.5	0.3	45
Chloride as Cl	3506	3607	3107	3207	3205	2800	2700	2060	2400	200
Fluoride as F	1.2	1.1	0.9	0.8	0.7	0.7	0.5	0.3	0.2	1.0
Sulphate as SO_4	168	172	112	154	185	135	130	130	118	200

Results are expressed in mg/L

5. RESULTS & DISCUSSION

5.1 Water Quality

The results of various water samples for the various physico-chemical analyses from various sites in the Pillayar Natham Mullai Pond are presented and discussed. The variation in the various physico – chemical characteristics of ground water quality by the seepage of the effluents from the sewage and various industrial effluents, gives the overall picture of the physico- chemical parameters of all the samples.

5.1 Sensitive Parameters

Parameters like hardness, calcium, magnesium, chloride and pH are taken as sensitive parameters to indicate the water pollution by industrial effluent from

various sources. It is observed that the values are higher compared the BIS Standards.

6. CONCLUSION

An attempt has been made to find the impact of the Pillayar Natham Mullai Pond in the ground water in and around the is study area. The ground water quality is very much affected in the Pillayar Natham Mullai Pond due to discharge industrial waste water from the industries area located near the study area. There has been a notable change in the occupations of people over a period of 25 years. There was a time when every family depends on agriculture; but now, only few people pursue agricultural operations. The rest have shifted to non-agricultural pursuits, such as wood cutting, laboring in small and big industrial units, cart pulling, loading and unloading goods and charcoal making. Effluents from the industries are discharged in to streams, which drain into ponds, thereby polluting the ground, water sources and cultivable land. Pollution due to effluents is caused by variety of chemicals used in the industries, including lime, sodium chloride, sodium carbonate, ammonium chloride, sulphuric acid, tannins and dyes. All industries need a large amount of water for processing and depend on groundwater sources for their daily requirements. The discharged-effluents from the processing units are stored in large lagoons Pollution occurs as the dissolved salts percolate into the surrounding water and soil sources. Thus, the ground water sources- are exploited to their fullest potential and polluted to a greater extent. A state of severe pollution results from the cluster of tanneries in close proximity to each other. Hence the polluted water is subjected to water treatment. Contaminated water is treated using reverse osmosis system. Reverse osmosis plant with high capacity is used for water treatment. Almost all the samples collected from various sampling sites from S2 to S9 are subjected to water treatment using reverse osmosis plant. The treated water collected from reverse osmosis plant after treatment is analyzed as per the procedure for water standard. The water becomes suitable for other domestic purpose with a low TDS People in the study area were advised to go for RO treatment plant to convert the well water and bore water for other domestic use.

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