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Physico-Chemical Assessment of Ground Water Quality in and Around Aranmanaikulam Pond, Dindigul City, Tamilnadu during Monsoon

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Abstract: Ground water samples collected from different locations in and around Aranmananaikulam pond Dindigul city during November of monsoon period were analyzed for physico-chemical parameters such as temperature, pH, TDS (total dissolved solids), electrical conductivity, total hardness, calcium (Ca), magnesium (Mg), sodium (Na), potassium (K) and chloride (Cl). Based on the various experimental results, it is arrived at the conclusion that the adjoining ground water sources are mostly affected and the water becomes very salty with very high TDS and that the ground waters are unfit for drinking purpose and some suitable treatments are necessary so as to keep the values of some parameters within desirable limits of BIS standards for drinking water. Hence the polluted water is suggested to water treatment using Reverse Osmosis System.

Keywords: *Ground Water, Sewage, Industry effluent, BIS.*

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I. Introduction:

In our daily life Water is absolutely essential to sustain life. In India ground water has a major role to satisfy the needs of domestic and agriculture purposes. In earth many sources being adversely affecting fresh water by various human activities. Dindigul is facing water quality problems as well as drinking water shortage, especially during summer season. Contaminated water leads many health problems and scarity of water makes human life unpleasant. Groundwater contamination is caused due the uncontrolled disposal of industrial and urban wastes and also the uses of chemical substances in agriculture process (fertilizers, herbicides and pesticides). Dindigul is surrounded by many Leather tanneries and small scale dying industries and their effluents are discharged in to the River causing impact on the quality of the underground water. Many of these substances will be discharged into the waste-streams to percolate the sewage system. Numerous studies in recent decades have focused on levels of sewage contaminants.

II. Scope and Objectives of the study:

The sewage from the houses located around the Aranmanaikulam pond and also from other canals discharged the polluted water into the pond without any treatment. Hence the water quality in the pond is badly affected. The contaminated water from the pond seeps into the wells and bore wells and thus pollutes the ground water sources around the pond. Water becomes salty and unfit for any use. Hence there is a need to study the impact of sewage water in the quality of pond water.

2.1. Objectives:

- To analyze the physico-chemical parameters of the Aranmanaikulam pond water during monsoon.
- To analyze the ground water quality parameters in the water resources in and around the pond.
- To recommend suitable remedial measures for the treatment of contaminated ground water using Reverse Osmosis Technology.

III. Materials and Methods:

The Aranmanaikulam pond located at Gandhiji road, near Madurai road belongs to Dindigul revenue department. The area of the pond is about 15.39 hectare. The pond capacity is about 0.9747million cum (or) 34.42million (FT).There are seven number of inlets adjoining in sewage water. The sewage from the habitant living around the pond at the distance of 5km are discharged through the drain into the pond, which leads to the pollution of the pond, at an alarming rate. During rainy season, the rain water collects in the pond. The rain water is the main source of water to the wells and bore wells located around the ponds at a radius of 5km.The rainwater collected in the pond is contaminated with sewage water, which percolate to the ground and reach the bore well and wells. This causes the pollution of the ground and well water, contamination makes the water very hard and salty, so the water becomes unfit for domestic and agricultural purposes. The polluted well and ground water used for agricultural purposes around the pond, this in turn affects the soil. It gets polluted slowly and become unfit for cultivation due to changes in the properties of the soil.

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3.1. Analysis of the Contaminated Water:

S.No	Parameter	Method of Analysis
1	Colour	Visual comparison
2	Turbidity	Neplo turbidity meter
3	TDS	Conductivity method
4	Electrical conductivity	Conductivity meter
5	pH	pH Meter
6	Total hardness	EDTA Titrimetric method
7	Calcium	EDTA Titrimetric method
8	Magnesium	Calculation from Total Hardness
9	Iron	Spectrophotometer
10	Ammonia	Nessler's Method
11	Nitrite	Spectrophotometer
12	Nitrate	Spectrophotometer
13	Chloride	Silver nitrate
14	Fluoride	Colorimetric meter
15	Sulphate	Turbidity method
16	Phosphate	Spectrophotometer

IV. Results and Discussions:

4.1. Drinking Water Standards:

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.

4.2. Comprehensive Table Water Quality Analysis:

Sample collection	BIS Limit	S1	S2	S3
Appearance		**Turbid**	**Slightly blackish**	**Slightly blackish**
Color (Pt.Co-Scale)	**5**	**Blackish**	**Slightly blackish**	**Slightly blackish**
Odour		**Objectionable**	**None**	**None**
Turbidity NT units	**5**	**84**	**16**	**12**
Total dissolved solids mg/L	**500**	**1826**	**5875**	**1206**
Electrical conductivity in Micro mhos/cm		**2685**	**8640**	**1773**
P^H	**7.0-8.5**	**7.57**	**7.54**	**7.48**
Alkalinity total as $CaCO_3$		**640**	**540**	**380**
Total hardness as $CaCO_3$ (mg/L)	**300**	**520**	**1920**	**460**
Calcium as Ca mg/L	**75**	**112**	**400**	**96**
Magnesium as Mg mg/L	**30**	**58**	**221**	**53**

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Sodium as Na	**_**	**320**	**900**	**168**
Potassium as K	**_**	**60**	**185**	**36**
Iron as Fe mg/L	**0.3**	**2.13**	**0.94**	**0.4**
Ammonia as NH_3 mg/L	**_**	**80.36**	**5.98**	**0.93**
Nitrite as NO_2 mg/L	**_**	**9.29**	**1.64**	**0.16**
Nitrate as NO_3 mg/L	**45**	**21**	**16**	**10**
Chloride as Cl mg/L	**250**	**430**	**2450**	**290**
Fluoride as F mg/L	**1**	**1.2**	**1**	**1**
Sulphate as SO_4mg/L	**200**	**64**	**245**	**44**
Phosphate as PO_4 mg/L	**_**	**7.74**	**4.54**	**1019**
Tidy's test 4 hrs as O_2		**17.55**	**5.06**	**4.33**

4.3. Sensitive Parameters:

Parameters like TDS, EC, total hardness, calcium, magnesium, Iron and chloride are taken as sensitive parameters to indicate the water pollution by industrial effluent from different sources. It is observed that in all the sampling sites in and around Aranmanaikulam pond these values are high compared to the BIS Standards.

V. Conclusion:

An attempt has been made to study the impact of untreated sewage water in Aranmanaikulam pond located at Gandhiji Road, Dindigul. In fact the sanitary wastewater comprises about 99.9 percent of water along with microorganisms. The pond water was used for bathing, washing and also agricultural purposes, but at present the pond has become the place for collection of sewage water from the houses located in an around the pond to a radius of 1km. So the water is completely polluted and reaches an alarming degree of pollution. In order to evaluate the physical, chemical and microbiological parameters, the water samples from the pond, wells and bore wells from the residence located in and around the banks of the Aranmanaikulam pond were collected. The physic- chemical analysis of water in the pond as well as the ground water sources around the pond reveals high turbidity. High TDS shows that the water cannot be used for domestic purposes. The electrical conductivity, total hardness, high chloride content in the pond as well as in the ground water sources indicates that the water cannot be used for human consumption. During the rainy season the rain water harvesting in the pond is essential to reduce the impact of sewage pollution by dilution. In order to improve the quality of ground water around the pond a suitable R.O system can be used to remove salts present in the well water.

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